APRIL, 1944 VOL. 33, No. 4

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

MAR 28 1944

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

Precision Built Milling Machines Since 1888

KEMPSMITH

KEMPSMITH MACHINE COMPANY • MILWAUKEE 14, WIS., U. S. A.

Shall our younger generation fight with gloves or machine guns . . . against a friendly neighbor or a deadly foe . . . in peaceful, back-yard surroundings or in blood-drenched battle fields? The answer depends on what YOU and I do on the production front. We must CONTINUE to produce vitally needed war equipment and supplies . . . in ever increasing amounts . . . to help the United Nations win the War. We dare not let them down. We must

STAY ON THE JOB!

A 4299-1PB-C

Greater OPPORTUNITIES

FOR TRAINEES TAUGHT ON MODERN LATHES

Today's production lines call for men skilled in the operation of modern machinery. Today's trainee, if he is to fit himself for such opportunities — if he is to make himself valuable for war production work — should be trained in the operation of full-sized war plant machinery.

Today's South Bend Lathes, embodying improvements developed to meet exacting war production requirements, are highly practical for pre-employment training.

Carefully designed for simplicity and ease of operation, these lathes have no unnecessary gadgets or intricate controls to confuse the beginners. Because they are so widely used in industry, their use for training purposes means a saving in on-the-job training time.

Made in 5 sizes, 9″ to 16″ swings. Write for Catalog No. 100-C.

SOUTH BEND
13″ ENGINE LATHE

SOUTH BEND LATHE WORKS

LATHE BUILDERS FOR 37 YEARS • SOUTH BEND 22, INDIANA

TEACHING HELPS FOR SHOP CLASSES

South Bend teaching helps — books, sound films, wall charts, and bulletins on the care and operation of a lathe — are available for school shop instruction. Write for Bulletin 21-C.

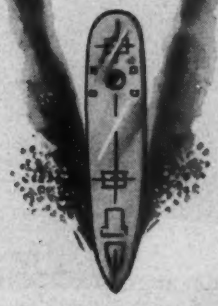
★ **First** IN WAR

★ **First** IN PEACE

★ **First** IN THE HEARTS of the LIBERTY SHIPS

Under the watchful eye of the U. S. Maritime Service . . . your Liberty Ships are rolling off the ways. Down where only the best can meet the test . . . you'll find the Sebastian Lathe... Down in the heart of the LIBERTY SHIP.

On the sea, and in the submarines under the sea . . . you'll find Sebastian Lathes turning true . . . moving right with the TIDE OF VICTORY in the game WHERE ONLY THE BEST CAN WIN



SINCE 1887... —FOR VICTORY

SEBASTIAN LATHES

manufactured by

STOKES INDUSTRIES

Cincinnati, Ohio

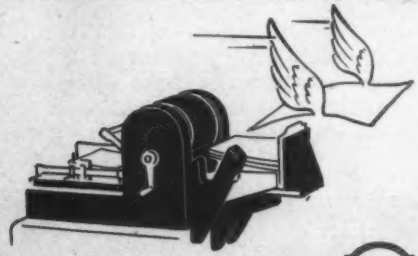
At their shoulders—while they work

When you turn out lesson sheets, course digests and class instructions on the Mimeograph duplicator, you've set them down in black and white, with clean, sharp visibility. Your students can read their copies quickly, without eye fatigue, and without error.

Industrial arts teachers all over the country have found that teaching helps produced with Mimeograph brand supplies on the Mimeograph duplicator are the most effective possible way of keeping their instruction individualized, in spite of larger classes and changing enrollments.

Your Mimeograph duplicator, and its quality partners, Mimeograph brand stencil sheets and Mimeograph brand ink, stand ready to help you in your important work. . . .

A. B. DICK COMPANY, Chicago.



MIMEOGRAPH is the trade-mark of A. B. DICK COMPANY, Chicago, registered in the U. S. Patent Office.

Mimeograph duplicator

For Instructors Only

Here's a practical approach to faster and better output from cutting tools, reciting authentic experiences of others who, by this simplest, most common-sense idea, have increased production from three to seven times without removing the tool from the machine.

It brings home these facts:

Speed in the present crisis is essential;
Tools and tool steel are precious;
Sharp tools insure greater production speed;
Hand stoning produces sharper tools;
Keeps tools sharper for longer periods;
Increases time between grinds,
Reduces waste of metal and setting-up time.

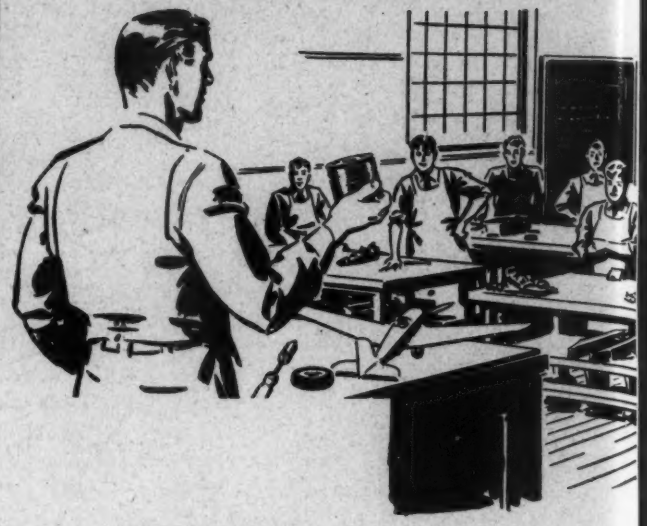
This book will enable instructors of vocational training and shop apprentice groups to focus classroom and shop attention on improved cutting tool performance.

Write for your copy today.

INDIA (aluminum oxide), CRYSTOLON (silicon carbide) and HARD ARKANSAS (novaculite) OILSTONES are available in dozens of shapes and grits to fit any type of tool.

BEHR-MANNING · TROY, N. Y.
(DIVISION OF NORTON COMPANY)
Also Reliable Coated Abrasives Since 1872

AFTER GRADUATION
Will your students have things to UNLEARN?



If you're teaching soldering the old hit-or-miss way — your students have much to "unlearn." Because soldering — the way it's done professionally, with Kester Flux Filled Solder — is a smooth, exact operation. Work is fast and sure because flux and alloy are applied as one. No messy separate flux. Results are neat and permanent. Even vibration, shock or bending will not affect a Kester Soldering job.

Use Kester Flux-Filled Solder in your classes. Teach your students the *right* way. They'll learn more easily, get better results, and take added interest in their work when they know they are working the materials they will use on actual jobs.

Start them right — with Kester. The superior work they'll turn out and the practical knowledge they'll acquire, will reflect credit on you. Order Kester Flux-Filled Solder from your wholesaler.

Finest Quality FOR 45 YEARS 1897-1944 KESTER SOLDER

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KESTER
FLUX-FILLED SOLDER

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, April, 1944, Volume 33, No. 4. Published monthly, except during July and August, by The Bruce Publishing Co., Milwaukee 1, Wis. Entered January 2, 1914, as Second-Class Matter at Milwaukee 1, Wis., under Act of March 3, 1879. Subscriptions — U. S., $2.50 per year. Canada and Foreign, $3.00. Single copies, 35 cents.

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Overnight from Anywhere in the U. S. A.

Factory-Branch Repair and Parts Service on Black & Decker Tools

ELECTRIC DRILLS AND TAPPERS

PORTABLE SANDERS AND GRINDERS

SCREWDRIVERS AND NUT RUNNERS

ELECTRIC SAWS AND SHEET METAL SHEARS

HERE'S another *reason why* American Industry uses more Black & Decker Portable Electric Tools than any other make: Only Black & Decker offers "Factory Service" so close at hand. In 25 major cities are Company-owned Branches, fully stocked with Black & Decker replacement parts, where factory-trained men give fast, expert repair service on Black & Decker Tools. And, *wherever you are* in the U. S. A., a Black & Decker Factory Branch is no more than overnight from your plant. Black & Decker Tools are saving time today throughout war industry—drilling and tapping . . . driving screws and running nuts . . . sanding and grinding . . . sawing wood and cutting sheet metal—on continuous production schedules.

Speed your production for war—and simplify the changeover to peacetime manufacture later—by standardizing on Black & Decker Tools. There's a distributor near you—a ready source of information and supply on the complete Black & Decker line. The Black & Decker Mfg. Co., Dept. 780, Towson-4, Maryland.

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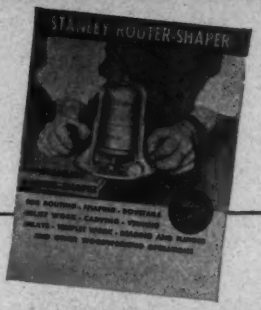
STANLEY No. 10 ROUTER-SHAPER

3/8 H.P. 18,000 R.P.M.

Let your boys put a professional finish on their work with a Stanley No. 10 Router-Shaper and you'll see a 100% response in added interest. Plenty of variety . . . use it for inlaying, veining, carving, dovetailing, rabbetting, and many shaping cuts. Its high speed motor, 18,000 R.P.M., permits smooth, clean cutting, both with and against the grain.

Catalog No. 606 gives the complete story. Be sure to have a copy for reference. Stanley Electric Tool Division, The Stanley Works, 112 Elm St., New Britain, Conn.



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ARMSTRONG

TURRET LATHE AND SCREW MACHINE TOOLS

Today, America Needs TURRET LATHE and SCREW MACHINE OPERATORS

The transition from tooling-up to all-out production has increased the need for turret lathe and screw machine operators. When preparing your courses to help fill this need it would be well to build them around ARMSTRONG TURRET LATHE and SCREW MACHINE TOOLS. These are provided for the basic operations, and take standard drills and knurls or cutters that anyone can quickly grind from stock shapes of high speed steel. Permanent, multi-purpose tools, they reduce tooling-up to the selection of cutters, adjustment for clearance and tightening of set screws.

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"The Tool Holder People" 322 N. Francisco Ave., Chicago, U. S. A.
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Every School Shop needs this versatile tool

LUFKIN COMBINATION SQUARE TOPS THE FIELD

This precision built tool, consisting of a tempered, machine-divided blade with square and center heads (cast or drop-forged) has so many varied uses as to be virtually indispensable to all mechanics working with metals.

Heads can be securely set quickly and accurately. Square heads have level glass and steel scriber. Graduated English or metric.

. . . Teach Good Workmanship With Good Tools . . .

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TAPES · RULES · PRECISION TOOLS

What will your †† future I.P. be?
This is the Second of a series of advertisements presenting "Industrial Par" and its importance to your company in all future planning. Save this and succeeding I.P. advertisements as the basis for discussion and as a guide to your planning program.
2% INVESTED IN MACHINE TOOLS
9 BILLIONS OF $
(VALUE OF PRODUCTS)

So much from so little

The Annual National Investment* in machine tools represents only 2% of the total value of products produced by machine-tool-using industries.

YES — in the ten peace years 1927 to 1937 — the builders of machine tools produced a yearly average of 122 million dollars worth of equipment for American industry. The industries that bought and used these machine tools were able to produce an average of about 9 billion dollars worth of peacetime products annually in those same years. The annual investment in machine tools represented only about 2% of the total value of products created by these machine-tool-using industries — the makers of engines and turbines, agricultural and construction machinery, automobiles, planes, locomotives, household appliances and many other useful things.

In terms of productive power this is impressive — certainly "very much from very little." But what significance have these rather startling ratio "figures" to industrial management? Industrial statistics show that the national output per man-hour tends to increase constantly — its previous rate of 2½% per year compounded can be expected to advance to 4% or 50% increased output per man-hour every 10 years.

Manufacturers who intend to keep step with a high level of national prosperity — the volume production which means more goods for more people at lowest cost and security of jobs and wages for the greatest number of workers — must strive to attain the 50% increased output pace. Certainly full advantage must be taken of the inherent ability of machine tools to achieve the most with available man-hours, for only with the most modern machine tools can any manufacturer hope to compete successfully over a period of years as well as make workers' jobs safer, easier, and more productive.

Isn't it only logical to equip your plant with machine tools — those possessing the greatest sustained productive power, the ability to produce fast, accurately at lowest cost — the better to win your race with competitors in the world of peace production to come?

Back the attack **BUY MORE BONDS**

Spotlight facts for your future I.P. *planning*

* Production methods — developed in wartime —increase man-hour output; pent-up buying power — released in peacetime — demands increased production.
* The rate of 2½% increase per year output per man-hour, established by a 12 year record of industrial production, can be expected to reach at least 4% per year — compounded.
* Manufacturers must set a goal of 50% increased output per man-hour every 10 years — to maintain a high level of national prosperity and achieve its benefits in terms of security of jobs and wages for the greatest number of workers and the volume production of more goods for more people at lowest cost.
* Machine tools — the most modern, most efficient — are recognized as the most effective implements of mass production and increased output at lowest cost — but only continual replacements with the newest and finest machine tools assures full productive capacity. *Such replacements yearly should be equal to 10% of the total machine tool investment — in keeping with increased output.*
* The cost of machine tools is insignificant in terms of their productive power . . . from 1927 to 1937, according to census reports, American manufacturers had only a total of about 2% invested yearly in machine tools in ratio to a total volume of 9 billion dollars' worth of production annually.

†† **Industrial Par** — *the constantly increasing output per man-hour equal to approximately 50% every 10 years.*

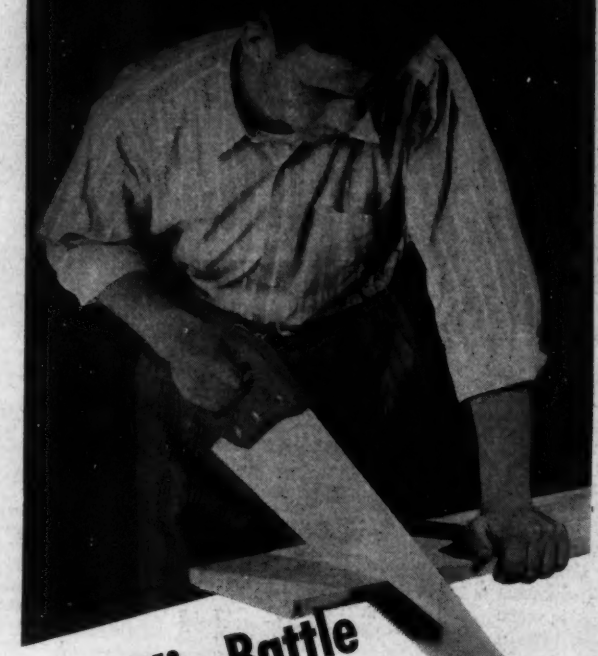
KEARNEY & TRECKER CORPORATION

MILWAUKEE 14 WISCONSIN

Milwaukee Machine Tools

THE advertisement above is reproduced from our current advertising campaign appearing in the business and industrial press. We believe these advertisements should be of interest and value to the young men who are being trained for tomorrow's industry, in terms of the trend and importance of machine tools to the industrial world of the future. May we suggest that you clip this advertisement and post it in your classroom or bulletin board so that it is brought to the attention of your students.

ATKINS



Half His Battle is Getting the "Feel" of Quality Tools

• To master a craft requires more than a willing pair of hands and an eager mind. Unless the tools a beginner uses "cooperate", he is apt to make slow headway. Recognizing this, many instructors favor Atkins Silver Steel Saws for manual training. Each saw in the line is carefully designed for easy handling qualities — and for accurate cutting on the work for which it is intended. There are types for every kind of sawing in wood, metal and plastics. The complete Atkins catalog gives full information —write for a copy today.

FREE—Wall Chart on Saw Fitting

Illustrates in detail the right way of filing and setting saw teeth, 19" x 25"— suitable for wall mounting. Write for free copy.

E. C. ATKINS AND COMPANY

404 South Illinois Street, Indianapolis 9, Indiana

Silver Steel SAWS

AGENTS OR DEALERS IN ALL PRINCIPAL CITIES THE WORLD OVER

URGENTLY NEEDED!

... By Uncle Sam

Although we are still producing Quality Woodworking Machinery for war, the fulfillment of wartime requirements will find Crescent ready to serve vocational educational demands immediately. There has been no conversion at Crescent. The demand for woodworking machinery behind fighting lines and in vital war plants continues to be urgent. Crescent's greatest contribution to the war effort was — and still is — to produce more and more quality woodworking machinery.

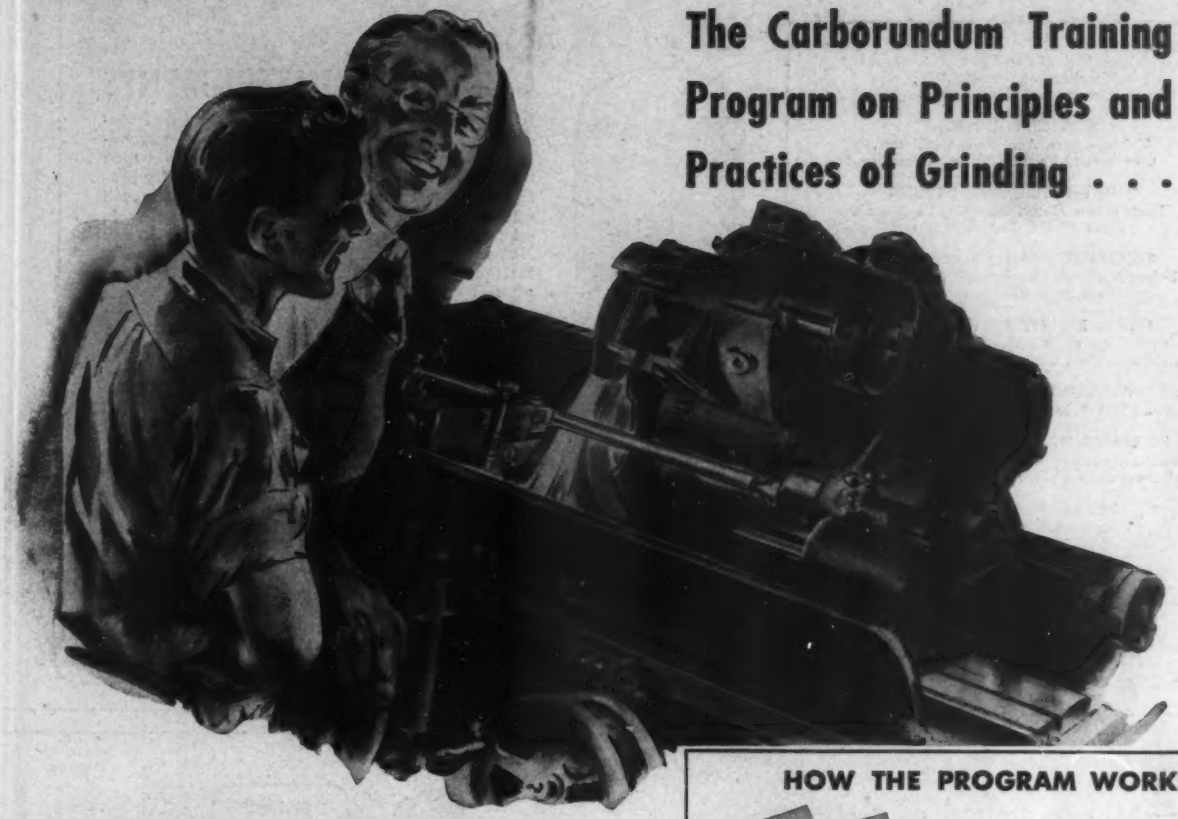
Increased facilities plus the engineering knowledge that have been acquired in this emergency will enable Crescent to serve school needs better. Anticipate your requirements now. Crescent is prepared to aid you. Descriptive literature is available on a complete line of quality woodworking machinery.

Write for it today.

Crescent MACHINE COMPANY LEETONIA OHIO

FREE! TO INSTRUCTORS

The Carborundum Training Program on Principles and Practices of Grinding . . .



NOW IN WIDE USE THROUGHOUT INDUSTRY!

TRAINING students fast enough and thoroughly enough to meet the needs of America's war program is probably the biggest job our vocational school system has ever tackled.

Here is our contribution to the solution of this problem—a streamlined course in the principles and practices of grinding, offered free to vocational instructors and students.

The purpose of the Carborundum Training Program is to explain in simple, non-technical terms the fundamentals of grinding and thereby help turn students into skilled workers faster.

Since its introduction, the course has been widely adopted throughout industry. We hope it may help you, as it is helping others, to simplify the training of students and to speed them on their way to higher production and greater accuracy.

THE CARBORUNDUM COMPANY

REG. U. S. PAT. OFF.

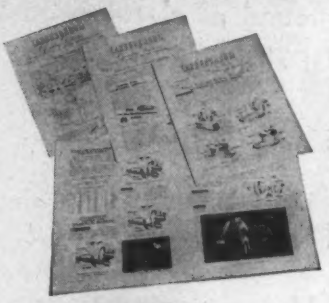
Niagara Falls, N. Y.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

HOW THE PROGRAM WORKS:



1. GRINDING BULLETINS. A set of 25 four-page bulletins for each student, offering a concise, non-technical discussion of grinding wheels and their functions. Sample of the contents: "The Abrasive Tools of Industry", "Wheel Stresses", "Wheel Balancing", "Cylindrical Grinding", "Grinding Errors", "Safety".

2. BOUND VOLUMES. A limited number of bound Grinding Bulletins are available for instructors as well as for placement in your classroom or technical library for reference purposes.

Educational Service Department
THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

We would appreciate your sending us added information on the Carborundum Training Program.

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Address .....

School.....

Courses taught (or title) .....

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FOR INSTRUCTION, TOO... *Industry's Test Instruments*
COST LESS . . . BECAUSE OF THEIR LONG-LIFE DEPENDABILITY!

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Portable and Switchboard — Potential and Current

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

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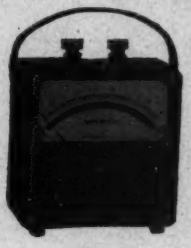
Voltmeters, Ammeters, Wattmeters

STANDARD CELLS

WESTON *MODEL 430*



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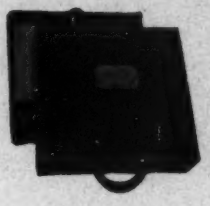
Ideally suited for classroom instruction and student use because of their dependability, ruggedness and relatively low cost . . . features which have made the Model 430 line so universally preferred throughout industry. Have hand-calibrated mirror scales of long length, with large scale openings. Accuracy within ½ of 1%. Sturdy Bakelite cases give added protection in service. Extremely compact. Available in complete line of A-C and D-C instruments.

WESTON *MODEL 785*



INDUSTRIAL CIRCUIT TESTER

A complete circuit tester for shop or laboratory. Has 27 voltage, current and resistance ranges (d-c voltage sensitivity 20,000 ohms per volt), for checking motor and control circuits, lighting circuits, sensitive relay circuits, communication circuits, etc., etc. Also available with compact resistance tester for checking insulation and cable covering resistance values up to 900 megohms.

WESTON ELECTRICAL INSTRUMENT CORPORATION, 595 Frelinghuysen Avenue, Newark, N. J.

Ready Soon

—the background of electricity needed for all radio work—

Slurzberg and Osterheld's

ELECTRICAL ESSENTIALS OF RADIO

Gives radio students the working knowledge of electrical fundamentals needed today to handle any type of radio set, test equipment, or electronic device. Provides the background of electrical and radio theory required to carry out repair and manufacturing jobs in the radio industry quickly and successfully, and to keep in step with the rapidly advancing science of electronics. No previous knowledge of mathematics needed except simple arithmetic.

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Are used the world over. Your plant cannot afford to be without one. Maintenance or production at a minimum time expenditure and capital outlay.

New illustrative literature for you. Write for: Bulletin UTG-43-IA for information on the K-O Universal Tool Grinder... Bulletin CTG-43-IA for information on the K-O Universal Carbide Tool Grinder.

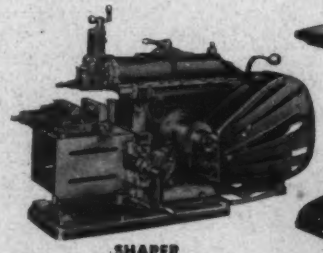
K. O. LEE COMPANY
ABERDEEN SOUTH DAKOTA

Atlas MACHINE TOOLS

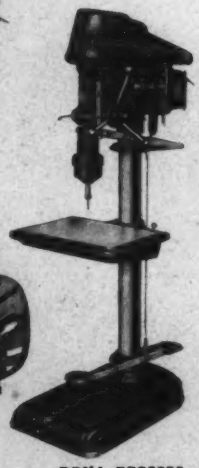
FOR THE POST-WAR CHALLENGE TO VOCATIONAL EDUCATION

ATLAS 10" F-SERIES LATHE
Swing Over Bed 10¼"
Swing Over Carriage 6⅜"
16 Spindle Speeds 28 to 2073 RPM
Thread Cutting Range 4 to 96 per inch
Four Bed Lengths 18" to 36" centers

MILLING MACHINE



SHAPER



DRILL PRESSES

Because thousands will need better training for jobs in our expanded industrial set-up . . . because millions of servicemen will need your help to take their places in industry . . . and because millions will follow machine tool hobbies, the demand for post-war shop courses will be tremendous. Atlas Machine Tools can help you meet this post-war need by giving more training per student per invested dollar. The Atlas tools shown here give precision training in every machining operation . . . at a fraction of the cost of unnecessarily larger machines. Get acquainted with these tools now — send for the new Atlas catalogs and the name of our nearest distributor.

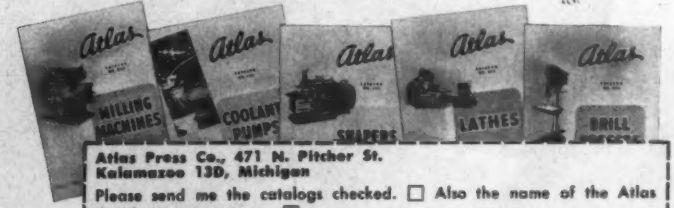
ATLAS PRESS COMPANY

471 NORTH PITCHER STREET, KALAMAZOO 13D, MICHIGAN

WALL CHARTS

Large, easy-to-read charts with up-to-date technical information on a variety of shop subjects are available at low cost.

Largest chart, on the Lathe, is 31½" x 25½". Others 16" x 21". These charts are ideal both for lecture work and also for using on wall for quick reference. Complete set of five charts sent postpaid for 25 cents.



Atlas Press Co., 471 N. Pitcher St.
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Please send me the catalogs checked. ☐ Also the name of the Atlas distributor nearest me. ☐

Lathe Catalog ☐ Shaper Catalog ☐ Milling Machine Catalog ☐
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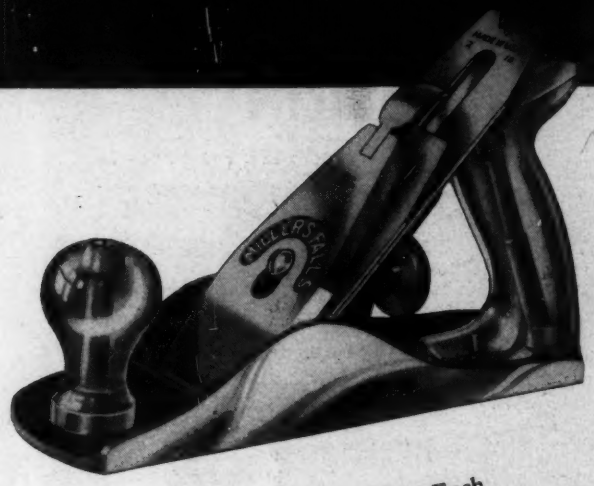
PLANES *with a* PURPOSE



Ten sizes — lengths from 7" to 24". Each serves a special purpose: short models for finishing broad, flat surfaces, reaching into low spots; jack, fore and jointer models are progressively larger, for increasing degrees of straight, smooth cutting. Also a broad line of block, rabbet, and router planes.

Three exclusive features give the Millers Falls plane greater durability and better performance:

- Three-point bearing lever cap
- Solid tool-steel cutter
- Perfect-fitting cutter cap

Millers Falls Trademark stands for top grade in tools — a reputation established over 75 years.

MILLERS FALLS TOOLS

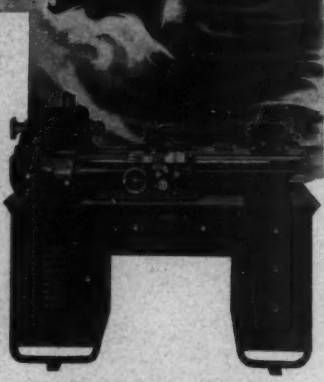
SINCE 1868

MILLERS FALLS COMPANY
GREENFIELD, MASSACHUSETTS

By the Army, the Marines and the Navy too.

SHELDON Precision Lathes have been selected by the Army for its Mobile Machine-Shop Units, by the Marine Corps for its trailerized shops and by the Navy as the ideal lathes for several types of repair shops aboard ship and ashore.

SHELDON Lathes are also widely used in British, Canadian, South African, Russian and other allied factories to speed the production and maintenance of war material . . . proof of the worldwide SHELDON accuracy and dependability.



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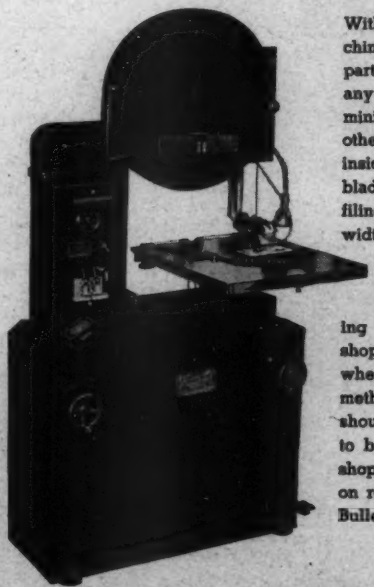

With this extremely versatile machine, tools and dies, machine parts or other items of practically any shape may be made in the minimum of time from steel or any other material; for it provides for inside and outside sawing, using blades 3/32" to ½" wide, chain filing — in three different file widths, and endless belt polishing. Because of this great versatility as well as the fact that these machines are being widely used in machine shops throughout the country where they are obsoleting other methods, a TANNEWITZ DI-SAW should be the number one item to be purchased for your school shop. Complete details furnished on request. Just ask for DI-SAW Bulletin.

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Important, too, are those Walker-Turner features which are particularly essential in industrial training—things like simplified design, easy operation, rugged construction and the latest in safety engineering. Moreover, Walker-Turner Machine Tools are priced to fit your budget, promptly available for war production training. Follow the lead of the industries for which your students are being trained. Send for complete story on Walker-Turner Machine Tools.

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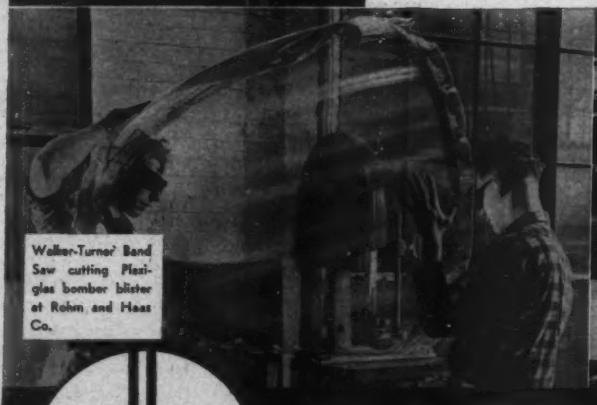

Walker-Turner Band Saw cutting Plexiglas bomber blister at Rohm and Haas Co.

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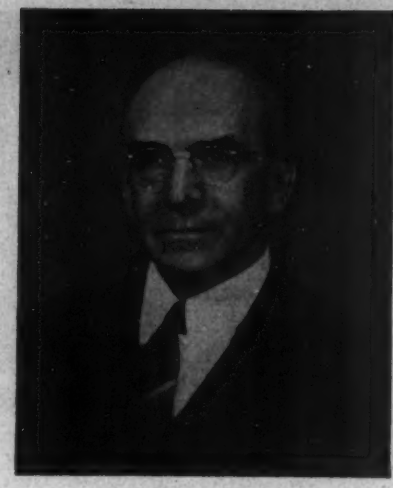
FILE "QUALITY"—WHAT IS IT?

BY *John E. Wiggins*
SUPERINTENDENT, NICHOLSON FILE CO.



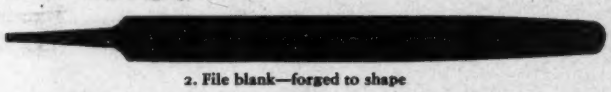
QUALITY is that virtue in a product that determines its worth. In food it is purity and taste; in flowers it is fragrance and beauty; in automobiles it is comfort, strength, speed, and economy of operation; in files and rasps it is cutting ability, long life, and uniformity.

Files and rasps of the highest quality cut rapidly, give proper finish, give maximum service, and do so uniformly, file for file of any given size or shape. The highest quality in files calls for uniformity of shape. All files in any given size or shape should, within reasonable limits, be exactly alike in measurements and contour. This makes necessary rigid inspections of steel as received to see that it is of the right shape and within the rolling tolerance for size.

Uniformity of shape also calls for the strict use of models in both Forging and Grinding departments; and for great care in Forging and Annealing departments to see that blanks are kept straight and free from kinks and twists, and when blanks are crooked after annealing to see that they are straightened before being ground. Uniformity of shape also calls for great care in the heat treatment, both in forging and annealing, to be sure that the steel is not decarburized on the surface, thus making extra grinding necessary and thereby changing the size.

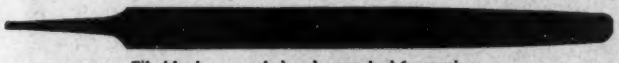
1. File "embryo"—a bar of steel cut to length

The drawfiling, setting and burring must also be carefully done in order to keep the shape uniform after grinding. Anywhere that material is removed from the blanks, or the blank is shaped in any way, strict use of models must prevail and frequent measurements taken in order to be sure that each size and kind of blank is of the proper shape and size, and uniformly so. Uniformity of shape and size is necessary as the blanks leave the Forging department in order that the grinding can be done properly and still have the blanks in uniform condition for the drawfiling operation.



2. File blank—forged to shape

Cutting ability is that ability the file has for removing material. The file having the best cutting ability is the one that removes the greatest amount of material in the least time and, at the same time, produces the finish desired. This quality is determined by the shape of teeth. There are many factors which enter into producing uniform teeth of the proper shape on each kind and size. Condition of surface, condition of steel and softness of blanks, uniformity of blanks, condition of machines, condition of cutting chisels, and many other factors must



3. File blank—annealed and smoothed for cutting

be carefully watched. Frequent use of the magnifying glass and comparison with samples of properly cut teeth are necessary to produce uniform teeth of the right shape. Every operation that has gone before has its place in the production of good file teeth. The softness of blanks must be uniform and in the proper condition. Cutting chisels must be right. This calls for real cooperation day by day between the Forging, Grinding and Annealing departments and the Cutting department.

4. The overcut—first series of teeth of a double-cut file

Long life in files and rasps is that high quality which makes the file or rasp continue to cut rapidly for the maximum amount of time. This is the quality which causes the customers to continue to buy a certain brand, and is the quality which keeps filing costs low. This quality of durability is determined by quality of steel as received and its subsequent heat treatment. No file or rasp is any better than the heat treatment it has

5. Upcut added—second series of teeth of double-cut file

received. Any and every place where heat touches our files or rasps has a bearing on the wearing qualities of our product. Time and temperature must be watched closely in forging, annealing and hardening. Furnaces and equipment, including pyrometers and controls, must be kept in good condition in order to avoid overheating.

The forging must not only make uniform blanks of the right shape, but avoid putting the steel out of condition while doing so. The annealing must not only have uniform softness in the

6. Finished file—hardened, tang blued, cleaned and oiled

blank, but must also leave the steel in the best condition for hardening. The Hardening department must not only get the files hard and straight, but must, at the same time, be sure that there are no cracks, and that the hardness is of the toughest possible kind.

The Finishing department must take the hardened files and sharpen them in such a way as to help the cutting ability and maintain long life. Nicholson makes *a file for every purpose*, which makes it necessary to have different degrees of sharpness for brass, steel, aluminum, plastics, wood, lead, etc.

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOL. 33 APRIL, 1944 Number 4

This Month's Cover

The cover picture shows a drill operator in an aircraft plant using a drill jig on the center section of one of our pursuit planes. On the final assembly lines the completed center section will be joined to other plane sections, and noses, engines, wings, landing gear, and other equipment will be installed.

—Official O.W.I. photograph.

Conventions

EASTERN ARTS ASSOCIATION, April 13–15, Pennsylvania Hotel, New York City.

ILLINOIS VOCATIONAL ASSOCIATION, April 13–15, Abraham Lincoln School, Springfield, Ill.

INDIANA INDUSTRIAL EDUCATION ASSOCIATION, April 28–29, Claypool Hotel, Indianapolis, Ind.

WESTERN ARTS ASSOCIATION, May 3–5, Hotel Statler, Detroit, Mich.

WISCONSIN VOCATIONAL AND ADULT EDUCATION ASSOCIATION, May 5–6, Schroeder Hotel, Milwaukee, Wis.

MICHIGAN VOCATIONAL ASSOCIATION, and MICHIGAN INDUSTRIAL EDUCATION SOCIETY, May 11–13, Hotel Pantlind, Grand Rapids, Mich.

Things to Do in March and April

▲ Make your Red Cross donation.

▲ Give a pint of blood for the men in our armed forces.

▲ Buy and use Easter seals sponsored by the National Society for Crippled Children, Elyria, Ohio.

▲ Buy more war bonds.

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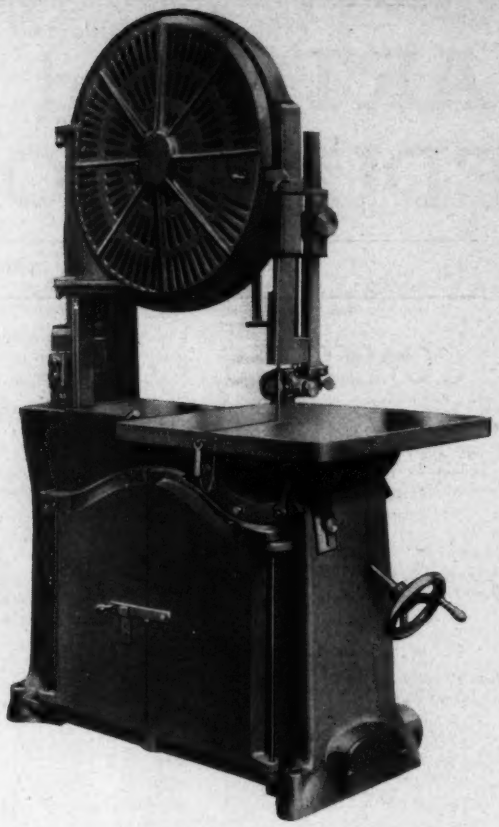

Y-30 BAND SAW

No. 52 of a Series

One teacher has placed students into two classes—the ones with the "bright eyes" and the ones with the "sleepy eyes". Bright or otherwise, shop students can operate the Y-30 Band Saw with exceptional ease and confidence because it was designed to afford the utmost convenience in operation.

To stop this saw quickly the operator need only pull a lever located at his side. This actuates an internal expanding, automobile-type brake which is lined with regular brake lining and and is adjustable for wear.

The table can be tilted conveniently, 45° to the right and 10° to left by means of a self-locking tilting device controlled by an easily accessible hand wheel. The upper guide bar is counterbalanced by a special spring sash balance. This relieves the operator of undue exertion when raising or lowering the upper guide.

Other features which make this one of the most desirable saws for teaching purposes are the knife-edge, spring-tensioned straining device and the convenient arrangement for tracking the blade.

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SHORT TALKS ON WOOD

DOGWOOD (*Cornus florida*)

Sometimes called the Flowering Dogwood because of the large, white blossoms which it bears in early spring. The wood is heavy, hard, tough and strong. Close-grained. Takes a high polish. Brown in color.

Usually marketed in blocks for use in the manufacture of shuttles and bobbins for textile mills, machinery bearings, photo-engravers' blocks, wedges and tool handles.

Generally distributed over the eastern half of the United States from New England to Florida and westward to Minnesota and Texas. Found on moist, shaded slopes and bottom lands where it usually grows underneath the larger trees in mixed hardwood forests.

A small tree, seldom over 30 feet high and 15 inches in diameter. The crown is flat and spreading, trunk is short and often crooked. Has a deep, spreading root system. A pleasing ornamental which could be planted much more extensively.

The bark is thin, dark brown to black and is broken into small, squarish blocks. The leaves are simple, opposite, oval, from 3 to 5 inches long and 2 to 3 inches wide. Bright green above, paler below. They turn to a beautiful red in autumn.

The true flower of this tree is a tight cluster of greenish-yellow florets. This is surrounded by four large, white bracts which give the blossom its distinctive appearance. The fruit is a bright, scarlet berry which is borne in clusters of 2 to 5.

YATES-AMERICAN

Area Vocational Schools

GEORGE H. FERN*

When America called its man power to war, it was without geographical or financial or religious or racial discrimination. Men and women were called upon to serve on the battle front and the food production front and in essential war industries. They have been called upon for their labor and their lives.

Today, the armed services are discharging men at the rate of 72,000 each month. With final demobilization there will be millions of returning veterans, all desperately eager to re-enter civilian life. Many will need immediate employment, married men who have families, or men desirous of marrying and establishing homes. Many will want to continue educational programs which were interrupted by the war. Added to those leaving the armed services there will be an army of warworkers who must reconvert to peacetime employment, plus the annual *crops* of school leavers and school graduates.

If this nation is to escape the catastrophe of its greatest economic derangement, it must prepare now for a planned, orderly, easy channeling of these millions of men and women into a new peacetime economy. The burden does not rest at the doorstep of business, or industry, or government alone. The public schools will be called upon for a greater service and a more immediate and general usefulness than even the war demanded. And the public schools are not equipped to give this service in thousands of American communities today. A careful plan for area vocational schools, made now, can greatly strengthen public education and help to meet the coming impact.

Few small communities, or school districts in remote and sparsely settled areas, ever have been able to offer a well-rounded vocational education program, adequate to meet the training needs of youth and adults, and prepare them for the many types of employment open in their own state. Even before the war emergency, the educational opportunities available to those living beyond the metropolitan areas have not been comparable to the situations in richer agricultural or industrial areas, and the ideal of "equal educational opportunity for all" has been a very distant vision rather than an actuality or even a possibility. Today, however, the need is accentuated. Veterans of this war will return to these communities with a wide experience, a world vision, and a knowledge of job possibilities which is not restricted to the home town and its immediate environs. They will return to their crossroad homes wanting more than when they left, and infusing into the home community their own broadened understanding of life and work.

If public education recognizes the diminishing importance of distance as a factor in the world today, and attempts to meet its added obligations, it must provide vocational training paralleling the needs of the people on a complete and broad scale, and to do this vocational programs must be developed on an area basis.

Plans That May Be Followed

Area vocational schools can be established according to any one of three plans. There may be (1) state schools, set up and operated through a state agency, with the support of state and federal vocational education funds; there may be (2) a county or a group of counties to operate such schools with local, state, and federal funds; or (3) strategically situated local schools may be designated by the state as area vocational schools, and that city school board may operate these schools with local, state, and federal funds, under an agreement with the state vocational board which establishes the areas to be served, the standards to be met, and the general policies and regulations under which the school will serve the designated area.

Under any of these possible plans, there doubtless should be state legislation providing for freedom of movement of students to any area vocational school where the desired courses of study could be obtained. In a state where state financial aid is given to a local school designated as an area vocational school, legislation probably would be required to enable one community to send students to another community where the school is located. In no case should tuition be charged by a school which is operated with state and federal vocational funds.

Should a state initiate a system of area vocational schools through its existing vocational education structure — that is, the local board of education, the state board for vocational education, and federal vocational education funds — the details of administration, supervision, teacher-training services, and the like, could be simplified and expense held to a minimum. The program could then start with fewer "growing pains" and immediate consideration could be given to the following essential factors:

1. Logical location for schools
2. Type of training programs (long-term, short-term) and curriculum
3. Inventory of existing training equipment and facilities which could be allocated to area schools
4. Equitable distribution of available equipment and facilities
5. Procurement of additional equipment and facilities as essential
6. Provision for transportation and maintenance of students
7. Policy for operation of the schools

Such an educational development calls for an appraisal of all available educational resources in the state, and planning with singleness of purpose: the greatest usefulness to the greatest number of youth and adults, and so for the ultimate benefit of business, industry, commerce, and society as a whole. Established boundary lines, local aspirations, political influence, and partisanship have no place on the planning table if a state hopes to establish a system of area vocational schools which will be truly educational and truly democratic. The planning must be state wide in its total concept, which involves sound administration as well as adequate financial provision and strategic location for these schools.

Postwar Training Needs

While the number and location of schools will vary with each state and should be determined on the basis of area and state needs and economic conditions, the type (short-term and long-term training) and quality of training programs doubtless would be similar throughout the nation. What, then, is the probable demand upon education in the months ahead in terms of training needs?

The men and women who return from the armed services know the value of specific training, for the army, navy, air corps, and marines have been operating with a clear understanding of the value of specialized training for specific jobs. "Behind every pilot there are 18 men on the ground." These men all have been especially trained for their particular jobs. The veterans of World War II know the value of vocational training and the amount of time the armed forces have given to the training of their highly skilled personnel. So the schools may anticipate, from

*Director, Michigan State Board of Control for Vocational Education, Lansing, Mich.

the veterans alone, a demand for long-term and adequate vocational programs to produce, ultimately, skilled craftsmen.

Industry broke down the work which must be done to produce war materiel into specific job operations, and workers were taught single skills, such as the operation of one machine, in order to produce quickly and in quantity. The schools trained warworkers for these single-skill jobs in short, intensive training courses and by that method stepped up our national industrial and agricultural output.

These were the types of training which went into operation in 1940, were intensified after Pearl Harbor, and which put the allied nations on the offensive in less than a year.

The schools may expect to be called upon for an extension of both types of training, and for instruction in whatever new area offers employment, all geared to the immediate needs of the people from now until far into the postwar era.

It does not take a crystal ball to determine the general pattern of employment after the war. There will be a demand for every kind of consumer and luxury goods, for replacement of household equipment and badly worn agricultural and industrial equipment; for improved transportation and communications. The wider use of plastics, the expanding field of electronics, popularization of refrigeration and air conditioning, a greater consciousness of food values, industrial use of agricultural products, all demand adaptations of old skills to new materials and occupations.

With ultimate demobilization, we will have many people trained for the same type of job and for one purpose — the work essential to vigorous prosecution of the war. There will be thousands of young men trained for radio and communications work, for all the jobs within the aircraft industry, and men trained to operate and repair trucks and tanks; there will be men and women who know the operations necessary in the manufacture of guns and jeeps and battleships. Some can continue in this or related work, but for thousands of others the job openings will be in the manufacture of refrigerators, stoves, draperies, furniture, hosiery, clothing, foods, metal alloys, prefabricated houses, and the myriad of other new developments now at our industrial threshold. The need for a national program of training for peace is self-evident.

Within nearly every state there now exists a nucleus for a system of area vocational schools which would meet the immediate need during postwar adjustment, and would lead to occupational adequacy in the future, if well established and well directed. The federal programs of vocational training for War Production workers and Food Production War Training necessitated the purchase of much new training equipment for the schools, in order to expand existing school shops or establish new ones. Assuming that this equipment is to remain in the states, and that title remains at least temporarily with the state boards for vocational education, careful and fair planning for its ultimate disposition can be started now on an area or statewide basis.

Making Equipment Available

Federal equipment, in nearly all states, has been kept mobile during the war-training program and has been moved from one training center to another as training needs changed. A lesson can be learned from this practice. There are some machines and certain equipment which are common to all machine shops, woodshops, or electrical shops. Therefore, some equipment will be in almost constant use and the available quantity should be equitably distributed according to type and extent of training needs. But there are other types of equipment which, in some locations, would be in use only part of the normal school year. With statewide planning, it is possible to provide a prearranged instruction schedule to make possible the maximum utilization of this equipment through systematic transfers. The instruction would be planned and timed for the various area schools and equipment transfers made according to schedule. Such a plan might necessitate also an agreement for itinerant teachers who would transfer from school to school with the equipment, thus reducing instructional costs to any one school and providing a job which would be full time instead of seasonal, and so attractive to a high type of instructor.

After available equipment has been allocated equitably to the established training centers, and provisions made for rotation of equipment which is scarce or is not in constant use, planning can be made to fill the gaps, that is, obtaining the facilities which are lacking and providing for operating and maintenance. If area vocational schools are financed on a three-way basis, (1) the local area, (2) the state, and (3) the Federal Government, the cost of obtaining equipment which is lacking would not be excessive to any one source of funds.

There still is the question of maximum utilization of equipment which is expensive or difficult to move. It easily might prove more feasible to move students to certain schools where there were good shops, adequately housed, lighted, and arranged, than to move equipment. This would be true also in the case of certain specialized equipment for courses not in general demand.

Provision for transportation and maintenance of students should be an integral part of the program for this, and also should be financed by state and federal funds.

In the months following demobilization, men and women will need and ask for training who have no resources other than their mustering-out allowance. One trip to visit friends and relatives, a few necessary clothes, a few well-earned good times, and the money is gone. Even if federal legislation provides for transportation and maintenance of veterans during such training programs, there is no similar provision now, as a general rule, for the out-of-school youth, the adults, and the in-school youth who need to attend vocational schools. In the years when veterans' training is a memory, these will be the school population of area vocational schools which function in a normal, peacetime economy.

Students Who Must "Work Their Way"

Many states have arrangements for payment of tuition for students living in a primary school district who must transfer to a graded district to continue their education. Similar provision should be made for those who live beyond commuting range of area schools and who must meet transportation and maintenance costs. Much of this cost can be met by the students themselves through work assignments at the school. Throughout the nation, college students have been "working their way" without any supervision or regulation of their working hours or jobs. A *department of work* could be established at each school, where all needed jobs (dormitory work, kitchen and cafeteria, laundry, gardening, building repairs and maintenance, and the like) are recorded and student hours assigned. Such a system would eliminate a recurrence of the unsatisfactory features of the NYA and would give to each student the satisfaction which comes from a self-supporting status. One of the lessons of the depression of the thirties was the demoralizing effect of the dole. Young people need to work, and to be paid for their work; they need to know the value of their labor and the importance of giving value in return for remuneration, in whatever form it may be received. They should not have to leave school before they are prepared for employment because they cannot finance their own vocational or professional educational programs.

Work done in partial payment for transportation and maintenance costs should not be confused with the work experience which should be a part of the organized instructional programs. If area vocational schools are to be practical, they must give sound and practical training in situations approximating actual industrial employment. Each trade course should be started and maintained on a production schedule patterned after industry, but utilized as a training vehicle rather than for production purposes as an end goal. A class should be conducted as a shop foreman operates his section of the plant. Schoolroom setups and *exercise work* never should creep into an area vocational school. Even in related instruction and in the general education program which should be an essential part of the curriculum, the rigid and formal classroom atmosphere and arrangement should be avoided.

Instruction should be individualized, and if the school starts on that basis, it can continue to operate as the War Production

Worker training programs operated. There were no starting and closing dates for those courses. As a trainee was ready for employment, he *graduated* and a new man took his place at the work station. The schools have learned to teach with such a flexible class enrollment, and area vocational schools can be similarly operated.

Flexibility, in fact, should be the foundation stone for the program. The curriculums should provide for the special needs of special groups, such as apprentices who might not be able to receive thorough training in their local industrial plants and might need a short-term course to *pick up* the training they lacked, in order to complete a well-rounded apprentice program.

Throughout the schools, in all departments, there should be the closest cooperation with the world of business, commerce, and industry. Even the best equipped and most thoroughly planned course can become outmoded and the training ineffective if instructors, supervisors, and administrators do not keep constant contact and close relationships with their brother workers in the actual world of work. Every new device, method, and material should be known. If industry can afford to scrap machinery and change methods, purchase new materials and teach new techniques, the schools can also.

Experience-tested teaching aids, such as training films, charts, and models, should supplement the traditional type of instruction in the classroom and shop, and instructors should be trained in the facile utilization of these aids. Any school that ignores new tools and techniques of education cannot expect to hold either the interest or voluntary attendance of its trainees. The lessons learned in vocational training for War Production Workers are a guarantee that the area vocational schools will not be guilty of this error.

Student Selection

Finally, there should be a well-understood and conscientiously observed program of student selection and occupational information and guidance, which should carry from the area vocational schools out into all of the public schools in the state, and to the lay public.

Not everyone is fitted, by interests and aptitudes, for a trade or business career. Many people will be misfits if they are forced into a vocational education program simply because area vocational schools are available and less expensive than some other type of educational program. Long ago educators discarded the theory that the vocational courses were the logical place for the backward, ill-adjusted students.

. Financial status never should be the basis for determining a person's choice of occupation. Information concerning employment possibilities in a field, interest in the work, and ability to do the work should be determining factors.

It is important that student selection should rest with the school administration and it should be possible for a school to refuse to accept for enrollment any person whose abilities were determined to be inadequate. There should not be a rigid minimum educational requirement however. Many young persons have determined to be inadequate. However, there should not be a rigid minimum educational requirement. Many young persons have been forced to stop school and find employment in order to help maintain their families. Such persons should not be denied the opportunity of returning at a later date, when the stress has been removed, and proceeding with vocational training at whatever level of mental development and occupational skill they may have acquired. Similarly, there are many adults whose years of experience and general knowledge should enable them to enter a vocational school for the advanced training or retraining which they may need. For all of these people, the curriculum should make provision for related subject courses in such fields as civics, English, mathematics, science, history; they should be able to enter these courses at the point where their formal education left off, just as they will enter the vocational program at the stage where they need vocational training and work experience. Instruction, then, in both the vocational courses and the related academic work should be individual, and the extent should be determined by the background and experience and actual needs of the individual.

If area vocational schools have full information concerning the trends on the labor market, the experimental work in the laboratories of industry, and developments in all of the fields in which they offer training, they should be able to give their students adequate occupational information, as well as aptitude and interest tests and vocational guidance which will enable them to make wise choices. If they can also give an extension type of service to the smaller schools which send students to them, and are a part of a comprehensive, state-wide program of education, they should make a great contribution to a superior national citizenry. People who are self-reliant, self-respecting, and possessing an appreciation of the rich heritage which is theirs in the many areas of science, literature, and the arts, as well as in their chosen trades and occupations, are enabled to live rich and useful lives, and to carry civilization forward.

Wartime Emphasis on Industrial Production and Its Effect on the Industrial-Arts Program

R. H. ROBERTS*

As we observe the activities in the industrial-arts shops of our secondary schools, we find that the wartime emphasis on industrial production has had a very definite influence on this program, and many significant changes have been brought about as a result. Some of these changes, without doubt, will tend to leave a permanent influence on this program, while others will quite likely drop out of the picture when war production ceases. Which of these changes will remain is, of course, a matter of conjecture.

It is not our purpose here to enumerate, or discuss all of these changes, for the reason that they are too numerous. We are simply discussing what in our judgment seem to be the most outstanding and the more common ones. We all recognize, of course, that these changes vary by geographic locality, depending largely on the proximity of large production plants, the type of production carried on in these plants, and the leadership existing in the various local schools. In connection with this discussion, we wish also to touch upon one or two important contributions which the industrial-arts program is making toward meeting the war-production needs and, likewise, discuss some instruments which have been developed by the War

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Manpower Commission and by Selective Service, which should serve as a valuable guide to both industrial-arts education and to vocational education in the future.

Girls Enrolling in Industrial-Arts Courses

Perhaps one of the most noticeable changes in the program is that of the decided increase in the number of girls enrolled in the industrial-arts classes in our high schools. In many schools, one half of the total enrollment in the industrial-arts courses are girls. In the Chicago schools alone the number of girls enrolled increased from 15 in 1939 to 25,000 in 1943. While this noticeable increase in the number of girls in the industrial-arts program was undoubtedly prompted by a desire to prepare for industrial work in war production, many of these girls are finding this work much to their liking and of definite value to their educational experience. There is every reason to believe that the interest in this work among girls will continue after the war, and thus project its influence on the entire industrial-arts program for years to come. Needless to say, the emphasis will change from the desire to prepare for jobs in industry to that of related training for the normal pursuits for women, for recreational activities, and for homemaking objectives. That is as it should be. However, this does indicate an expansion in the industrial-arts program in our secondary schools after the war.

This interest and desire on the part of girls participating in the industrial-arts program has not been brought about entirely by the war. Many of our progressive schools have been aware of this interest for some time, but all available facilities to these schools have been constantly utilized by the boys. Because of a lack of funds with which to purchase additional equipment and suitable classroom space, these girls have been denied the privilege of participating in this program. However, with a large number of the boys of junior and senior rank entering the services, some of the facilities of this department were made available, and the girls of the schools took advantage of this opportunity. A decided lack of interest on the part of industrial-arts teachers to develop a suitable and practical course for girls has also been a deciding factor in this matter. This lack of interest and ability on the part of our industrial-arts teachers can, for the most part, be traced to the lack of leadership in our teacher-training institutions. Many of these institutions are still geared to the program which our secondary schools were carrying on 10 and 15 years ago.

Industrial Arts and Guidance

While the major objective of our industrial-arts training is not the development of skills for a specific trade, this training has been of tremendous service both to the individual who has planned to enter industry as a war-production worker, as well as to the industries who have been so hard pressed for workers. Here the important factor of practical guidance is functioning at its very best. In the well-organized industrial-arts program, probably the one most important general contribution which this program makes toward the preparation of workers for a job in industry is that of guidance. This contribution is even more pronounced in the training of girls than it is with boys.

Let us consider for a moment what this contribution has meant. The opportunity to sample, in the various industrial-arts classes, the work experiences involved in performing a job in a certain field in industry, represents a saving of much time on the part of the individual worker and of industry. It is obvious that the boy or girl who experiences an utter dislike or a lack of aptitude for a certain type of job will not make the mistake of attempting to enter that field or take further preparation for it. This experience has undoubtedly guided a large number in their choice of training which they have taken in preparation for working in the war industries. It has not been possible for the schools to set up a program which would give its students experiences in all jobs connected with industry, but those experiences which have been offered have served as a definite guide. In addition to this, the offering of these work experiences gives the industrial-arts instructor an opportunity to observe the abilities, and to discover the aptitudes of his students. After all, there is no better means of determining a worker's ability and aptitudes than by observing him at work. When these abilities and aptitudes have been discovered by the instructor, he is then in a position to offer guidance assistance to those in his class group. During this emergency, industrial concerns have called upon the industrial-arts instructor constantly for his estimate of the abilities and accomplishments of his students. Here he has been of real service both to industry and to the student.

New Courses Added to Curriculum

Another important change which the war has brought about in our industrial-arts program is that of course content and curriculum changes. It has streamlined its program, so to speak, to fit more closely the needs of the present crisis. Some industrial-arts departments have set up new courses and have equipped new shops to give instruction in some of the new fields which have come into being as a result of the war. The aircraft industry with its new production problems has probably had more influence on these changes than any other single industry. The tremendous demand in this industry for the fabrication of light metals has had a decided influence on the metalwork and the woodworking fields especially.

In this connection, some schools have developed courses of instruction in aircraft metalwork, aircraft installation work, and aircraft mechanics. These classes have been organized on an industrial-arts basis rather than a vocational training basis in order to provide the opportunity for a greater number of students to receive the training. Since one of the major purposes in offering this training in this field was guidance, it was felt that class periods of one or two hours in length was entirely sufficient. The courses were offered especially to the sixteen-year-old senior boys and to senior girls, so that they might receive some actual experience in this kind of work to assist them in determining whether or not they possessed the proper aptitudes and desire for the work. Since the necessary skill to perform many of the jobs in these fields can be developed in a short time, it was found that those students who applied themselves carefully, and those who possessed a reasonable aptitude for this work, were able to develop enough skill to perform the job satisfactorily after completing a one-semester course with a class period of one hour in length.

Courses in aircraft welding have also been organized in many schools. Interest in the entire field of welding has shown a decided increase in the industrial-arts departments and in many instances this work is entirely new to the curriculum.

As we observe the work which is being done in our machine-shop classes, we find that the projects used in these shops have changed considerably. Previous to the war, the students in these classes were given considerable latitude in the choice of the project. At that time, these were chosen largely on the basis of their aesthetic and utilitary value to the student. At the present time, the projects are chosen largely by the instructors. There are two reasons for this: first, because materials are limited; second, because the instructors are anxious that the students receive as wide a range of manipulative experiences as possible and that they acquire as many skills as possible in this training period. For that reason, most of these projects are nothing more than a series of exercises which provide the important work experiences and the opportunity to develop the skills most needed in industry. We also observed that the emphasis here is in developing machine operators rather than the all-round workers. More emphasis is also being placed on benchwork in the metalworking field. This work is started on the junior high school level, and is providing a splendid foundation for the prospective worker in the machine tool industry.

Training in inspectional and measurement work in several fields has also been added to the program. Here stress has been placed on the accurate use of the measuring instruments in the field, on the study of the various materials used and the identification of them, on standards of workmanship, on the mathematics involved in measurement, on the development of the various jigs and devices for use in inspection, and many other things

necessary in doing this work in an industrial plant.

The general sheet-metal course which has been traditionally a part of the average industrial-arts program has undergone a rather radical change. The use of the lighter metals in aircraft construction and the different methods of fabrication of these materials has influenced this course most. Here instruction in riveting, drilling, and forming has largely replaced the processes of soldering, using the crimping machines and other commercial sheet-metal practices. Instruction in layout is still, of course, an important part of this course, since it is important to aircraft construction. The making of templates and the development of jigs for the purpose of developing accuracy and speed in mass production is also being emphasized in this course now.

Foundry Work and Patternmaking

A new emphasis also has been placed on training in foundry work and in patternmaking. These fields have never been among the more common offerings in our industrial-arts program, but they have received considerable impetus since this era of heavy production for war materials.

We observed last year that the instructors of electricity in the Tulsa public schools met for a two-hour session, two evenings each week, for 16 weeks to study the fundamentals of radio and radio repair work. This same group is meeting regularly this year to develop instructional outlines and materials to be used in their classroom instruction. This indicates that the study of radio is rapidly finding a place in our electricity courses. It adds much to the enrichment of these courses and is a refreshing substitute for some of the old practice of wiring bells and buzzers. It has had a very stimulating effect on both students and instructors. Undoubtedly, this same change has come about in industrial-arts shops all over the country.

The drafting courses likewise have been influenced by the change in production demands. While the fundamentals of mechanical drafting and machine drafting are still holding a prominent place in the work of this department, various phases of aircraft drafting have almost entirely crowded out the architectural drafting work which had become quite prominent in our program in recent years. Probably the most outstanding change in this field, however, is the strong emphasis which is being placed on blueprint reading work. This, undoubtedly, has been one of the weakest phases of our training in the drafting field as well as in our shop courses in years past.

Woodworking, probably the most common of all the courses in this department in our high schools, also came in for considerable change. This was especially true at the outset of the war period. At that time, considerable wood was used in airplane construction. This fact influenced the development of instruction in woodwing construction, in jig building, and other such activities along the line of aircraft construction. Much of this work was done from blueprints which had been developed in the aircraft factories. Glider construction work and model airplane making has also taken a prominent part in this field of work.

Considerably more emphasis has been placed on instruction in safety in all of the industrial-arts fields recently. The pressing of abnormally young, inexperienced, and inadequately trained workers into our war industries has made this even more essential during this emergency. This is doubly important in our training for girls. The thought of losing the many years of productivity of one of these young people, the immediate loss of their assistance in winning the war, and the economic problems which always develop with serious accidents have made us all very conscious of our responsibilities in this matter. The important factor of protecting the tools and machines which these people are using in industry, as well as in training, and which are almost impossible to replace has also emphasized the importance of instruction in safety.

In many of our classes, more emphasis has been placed on the development of skill. Specialization has been encouraged, and considerable technical information has been given. Some shops have narrowed their work down to fewer units so that they would have time for more thorough coverage of what they felt were the more important ones in the development of the fundamental skills and in acquiring the most important related information in the field. These shops are also limiting the tools and machines which the student uses, and are stressing the development of more skill in their use. They are stressing the training of machine operators rather than the all-round worker.

All this has, of course, been done as a result of the war effort. This does not mean that industrial arts is attempting to take the place of vocational education. The limitation of time, equipment, and of general working conditions make it impossible to give comprehensive training in a skilled trade. Instructors in this work have felt that a large percentage of these young people would enter industry at the earliest possible moment after completing their schoolwork. For that reason, they were anxious to give them as much specific training as possible before they left school. This new emphasis on the developing of basic skills to such a high degree should be considered temporary in the industrial-arts field. This should again be replaced by a broader type of work and should aim at giving more informational material and more opportunity for exploration after this war emergency is over.

New Vehicles Produced

In addition to the previously mentioned changes which have come in the industrial-arts program, this period has produced some vehicles which should prove to be of assistance in planning the industrial arts as well as the vocational-training programs in the future. Prominent among these is the Manning Table Plan, which was first introduced during the latter part of 1942 by the War Manpower Commission and the Selective Service System.

Among other things, the Manning Table constitutes a complete man-power inventory of the industrial plant. It lists all of the jobs in the plant, the number of persons presently employed in these jobs, the time required to train inexperienced people, the number of physically handicapped workers employed, jobs which women could do, jobs where handicapped workers can be used, and several other pertinent items. Many of our larger industries have had a comparatively complete record of their man power. But this is not true among our medium-size and smaller industries. These industries have kept accurate inventory of their physical equipment, including their tools, machines, materials, and the like; but have never developed such an accurate inventory of their man power. True, they knew how many men they had on the pay roll and some very general information concerning these workers, but on the whole, this information was entirely inadequate.

In preparing a Manning Table, it is necessary for the establishment to break down all the jobs in the plant in order to know what experiences, abilities, and training is necessary for workers to have in order to successfully do these jobs. It is necessary for the plant to furnish a job description for each job in the plant. The job descriptions found in the *Dictionary of Occupational Titles* may be used if the employer feels that these descriptions are adequate. If these are not adequate, the employer may prepare his own description. Many groups such as the oil industries and aircraft industries have developed an occupational dictionary to cover their own fields.

This groundwork having been laid and this awakening to their lack of pertinent information concerning the requirements of the jobs in their plants has prompted management in many industries to develop a complete analysis of the man-power requirements in their plants. In some instances, they have worked out a complete chart listing all jobs in the plant and outlining the educational requirements, physical requirements, previous experience required, the mathematics and science involved in the job, the lines of procedure for advancement, and a complete breakdown of each job to show just what the worker must be able to do to perform the job. This makes it possible for each worker in the plant to know specifically what are the requirements of the next job higher in skill than the one he now holds. Therefore, if he plans to move up to that job when an opening occurs, he may take some training which will help to prepare him for that job. It will also assist the personnel department of the plant to know

what the exact requirements will be of each individual when he is hired. Thus, the individual who fits the job requirement will be hired rather than following the old policy of hiring the individual with some general qualifications and hope that he will be able to do the job.

This experience of preparing a Manning Table has made management of industrial plants much more conscious of training needs, and of how training can assist them in meeting many of their man-power and production problems. It has also indicated to management that under a carefully planned training program, the length of time required to train workers has been materially reduced. It likewise has pointed out to management the importance of much of the basic training which the industrial-arts program has given to their workers.

Occupations Grouped Into Families

The *job family series* information which has been prepared by the Occupational Research Program of the United States Employment Service, a division of the War Manpower Commission, is another vehicle which should prove to be of assistance in the future planning of our industrial-arts work. While this material has been prepared for the purpose of aiding in the placement of men in jobs, yet it has a contribution to make to training. It is not entirely a new idea or a new development. It incorporates some facts which have been known for some time by the careful students of industrial-arts work, with a careful study of job requirements, and from these, the material has been compiled.

What is the meaning of the *job family?*

Even the simplest occupation is made up of numerous elements. To describe any occupation accurately and adequately, it is necessary to know in rather close detail the kind and form of material handled; the tools, machines, or equipment used; the special knowledge involved; the elements performed in the job; and the abilities required of the worker in the use of the tools, in the handling of the materials and the application of this knowledge. These are the basic things which distinguish occupations from each other.

However, it is not difficult to see that no two occupations would have exactly the same elements. Therefore, in preparing to group occupations into families, it is necessary that these numerous elements and requirements be reduced to a few basic ones. In the family groupings which have been made, the following three characteristics have been taken into account:

1. Similarity in the nature of the work performed
2. Skills and worker characteristics required
3. The equipment and work aids used

The grouping could be made on the basis of similarity of only one of these characteristics, or it could include only two, while again it might be made to include all three. The job family series which have already been published include, for the most part, those occupations in which a similarity of all three of the previously mentioned characteristics have been found. As an example of this procedure, we might choose an occupation which involves, basically, the process of melting. In this process, certain equipment and tools are used and certain worker characteristics are required in an above-average degree. This work, with these tools and equipment and other requirements, is performed upon a certain type of material. By bringing together all occupations requiring these or similar factors in various degrees, a job family is formed.

An example of a family as outlined in the job family series covering the machine tool manufacturing industry is listed here in an effort to make this discussion clear. The listings are made in two groups, *A* and *B*. In group *A* are listed the key occupations, and in group *B*, the related occupations.

Key Occupations

A–2

4–75.010 Machinist II
Machinist, floor
4–75.140 Machine layout man
4–75.160 Job setter II

Related Occupations

B–2

a) 4–78.021 Screw-machine operator
4–78.042 Horizontal-boring-and-milling-machine operator
b) 4–78.011 Engine-lathe operator I
4–78.012 Speed-lathe operator
4–78.021 Turret-lathe operator
4–78.022 Vertical-turret-lathe operator
4–78.041 Vertical-boring-mill operator
4–78.043 Jig-boring-machine operator
4–78.071 Planer operator II
5–84.110 Tool-grinder operator

The number which appears to the left of the occupation indicates the code number under which the occupation is defined in the *Dictionary of Occupational Titles*. By reading these definitions, one gets a definite outline of the duties performed by the workers in each occupation. In this way, we are able to see the definite relationship of one occupation to the other.

Some of the specific benefits which should come from the two vehicles just mentioned are these:

1. They will assist in building a training program which will give training in families of occupations rather than in one occupation.
2. They will tend to give more spread to our industrial-arts courses.
3. They will assist our high school youth in learning exactly what are the requirements of the various occupations.
4. They will outline to the learner just what job experiences he must have on each job before he is ready to be upgraded to the job in the next higher skill bracket.
5. They will set forth definitely the mathematics, science, and other related work which the learner must master in preparation for the various trades. This will eliminate any doubt in the mind of the high school boy as to whether these requirements are necessary to success in the job.

To summarize some of the more general effects and contributions which this period has produced, the following should be included:

1. Management of industry has been awakened to see the values of our industrial-arts training.
2. The general public has had its eyes opened to the need and value of such training.
3. School administrators and other school officials have become much more vitally interested in the industrial-arts program and have been brought to see the practical values derived from it.
4. This period has awakened a new interest among the instructors to explore new areas in this field of instruction, and has furnished many more opportunities for them to learn what are the exact worker needs in industry.
5. This period has awakened the interest in, and has renewed the efforts of, members to look after the repair and maintenance of equipment in the home. This renewed interest, in turn, has influenced our industrial-arts program.
6. The Manning Table and job family information have especially given our industrial-arts departments some definite aids toward developing an effective counseling and guidance program in our schools.
7. A new emphasis has been observed in the statements of objectives for our industrial-arts programs.
8. Many new aids have been developed by industry, the Army and Navy, and some government agencies, which should prove to be of considerable value in revising our entire school curriculum and especially should become valuable instructional aids for industrial arts. Some of these are: mechanical aptitude tests, various kinds of visual aids, and written instructional materials, including those which have been prepared by the various training agencies.

Teacher-training institutions and those in charge of the industrial-arts programs in our secondary schools should be constantly alert to make the maximum use of these contributions. They should bend every effort to assist our instructors in this field to be informed of these.

He that pays ready money might let that money out to use; so that he that possesses anything he has bought pays interest for the use of it. Consider then when you are tempted to buy an unnecessary household stuff, or any superfluous thing, whether you be willing to pay interest, and interest upon interest for it as long as you live; and more if it grows worse by using.—*Benjamin Franklin.*

Some Problems in Training Teachers of Vocational Agriculture in Farm Machinery Repair

S. H. FOOTE*

Prior to setting up any program of teacher training in vocational agriculture a thorough knowledge and appreciation of the problems encountered by the teacher in the field of agricultural education at the secondary school level is essential.

The machinery repair program as promoted by the Virginia teacher of vocational agriculture accounts for 20 to 50 per cent of his teaching hours. The rest of his time is devoted to teaching general agriculture and other subjects in his all day classes, assisting in such school routine as he may be assigned to by his principal, teaching adult evening classes in specialized production courses under the Food Production War-Training Program, and general supervision of the local canning center. This general supervision of the canning center includes work on the family basis planning food needs, producing the things needed on the farm and then processing the food either at home or at the canning center. We must recognize the fact that the machinery repair program is only a part of his regular duties. It is a large part, however, and is different from some of his other teaching projects in the fact that it is carried on with not only his adult groups, but also with his regular all day pupils in vocational agriculture. A further difference in this teaching is that with the adult groups he has the assistance of a local mechanic who is paid on the hourly basis for this work.

As an educator, the teacher of vocational agriculture must have certain well-defined objectives if he is to teach effectively any course, whether it is poultry production, soils and fertilizers, or farm-shop work. The problems that he meets in reaching his objectives must be our problems. The objectives of our teacher-training program to be effective and worth while must be to some degree the same objectives which he will set up in his own machinery repair course in the high school. In addition to these objectives we must set up others which will promote his efficiency in all phases of this program.

In the Virginia program of teacher training in farm shop we have set up four principal objectives for our trainees.

These objectives are:

1. To develop an educational philosophy toward farm-shop work which will put this type of teaching above the recreational value and establish it on the solid foundation of true vocational teaching. The vocational-agriculture shop must never degenerate to the level of a service center to which persons in the community bring worn and broken equipment for the teacher and his all day students to repair. It should, instead, be a place in which these people can find the tools and other physical facilities, plus the advice and assistance of the agriculture teacher in solving their problems and making their own repairs and adjustments under his supervision. The procedure then becomes a device for enlarging the scope of his teaching, and his immediate objective should be to so teach that particular skill that it should not be necessary again for that person to seek help on the same problem. Two important subsidiary or *follow-up* objectives are: (1) the establishment of a home farm shop, and (2) adequate housing facilities for all implements and machinery.

2. Our second trainee objective is to develop the art of tactful and efficient supervision. The patron who abuses tools or uses a piece of shop equipment incorrectly should be advised as to best procedures. The teacher must have sufficient printed reference material so the adjustment or repair with which neither he nor the patron is familiar can be correctly made. Shop tools must have a definite storage place when not in use and part of the teacher's supervisory duties must be to encourage the return of them to their proper places when the patron finishes with them.

3. Our third objective is to promote the art of successful demonstrations. When an individual problem of repair or adjustment appears which may be common to other patrons working in the shop at the time, the most efficient teaching is the demonstration method in which all witness the actual doing of the job at the time. This entails the actual *know how* of doing the job on the part of the trainee.

4. The development of shop managerial ability on the part of the trainee is our fourth objective and is just as important, if not more important, than any of the other three. The shop would soon be in chaos if a labeled place were not provided to store tools. Benches and equipment must be arranged so that the maximum number of patrons can work efficiently in a small floor space. Supplies must be provided, and provision made for an adequate system of purchase and sale records of them. Some financing arrangement must be made for replacement of worn-out and broken shop equipment. The shop must be kept clean, and warm enough to work in in cold weather.

These four objectives are the goals toward which our teacher training is directed. Our methods are (1) resident teaching at Virginia Polytechnic Institute, and (2) itinerant training in the individual teacher's school shop.

In our resident teaching we have two types of trainees: the regular college student who is preparing for his teacher's certificate in vocational agriculture, and the teacher in service who returns to our institute for a short summer course in machinery repair.

For the regular trainees we require as prerequisites three courses in general shopwork before he can take the machinery repair course. In addition to these required subjects he also must have satisfactorily completed courses in farm buildings, agricultural drawing, surveying and drainage, and farm power machinery before receiving his teaching certificate.

As a concession to the war emergency, we have waived all prerequisites to the machinery repair course for in-service teachers. As the present regulations regarding required shop courses have only been in force since the fall quarter of 1941, these in-service teachers have widely varying backgrounds in shop training.

To meet the needs of these in-service teachers we have developed several types of short courses. For those who have had little or no previous shop training we offer a one quarter course in general shopwork which is designed to familiarize them with the shop skills essential to machinery repair. This group of trainees is made up largely of former academic teachers and principals who are qualifying to teach vocational agriculture in a series of summer sessions.

A second course designed for trainees who have the necessary background in hand tools consists of arc and acetylene welding, forge work, and machinery repair. This is a two-weeks' intensive training course which meets from 8:00 a.m. to 4:10 p.m. every day and carries the equivalent in college credit to one half quarter's work in a regular course.

A third course for those who have had the two courses just mentioned, or their equivalent, consists of machinery repair

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and such machine-shop practice as lathe work, milling machine, and shaper operation, precision grinding, and hand scraping. This is also a two weeks' intensive course. Both of the two weeks' intensive courses include night meetings which are conducted as open forums in which the trainees discuss their individual shop problems. These meetings are not compulsory but attendance and participation have been excellent. The regular full quarter courses carry a half-hour lecture period at the beginning of each three-hour session covering the management and skill phases of shop instruction.

In addition to these three standardized courses which have been set up to meet the war needs in training of in-service teachers we are continuing to offer our three regular general-shop courses on the undergraduate level, plus three advanced shop courses on the graduate level available to undergraduates as electives. In one of each of these series of three courses, machinery repair is the major topic of instruction. Each course meets for two three-hour periods weekly for one quarter.

We have also conducted special short courses on two different occasions at the request of the vocational education department of the college to specifically meet the needs of groups of emergency teachers.

Not all of these courses are directly machinery repair courses, but without exception they are directly related to machinery repair in that they cover the essential skills necessary to promote such a program intelligently.

For all types of beginning trainees we find several problems that are common:

1. They are unfamiliar with names, use, and care of shop tools and equipment.

2. They have the recreational rather than the vocational attitude toward all kinds of shopwork. As a result they are *poor housekeepers*, and must be trained to replace tools in their proper places when through using them, as well as all the rest of the mechanics of operating a shop program of instruction wisely and efficiently.

3. They are unfamiliar with the proper adjustment, care, and repair of even the commonest farm implements.

From the administrative viewpoint some problems of teacher training in farm machinery repair are as follows:

1. Shop space and equipment are inadequate in many colleges.

2. Many college administration officials do not recognize the need for sufficient personnel on the instructional staff so that the maximum ratio of students to instructors does not exceed 10 to 1.

3. Not enough time is allowed the trainee to get a thorough training in general shopwork before attempting machinery repair which requires in itself an accumulation and practicum of all shop skills. This time allotment is usually insufficient on machinery repair itself to admit of instruction on any more than the commonest farm implements.

4. Availability of machinery needing repair which can be used for shop instruction is a problem.

5. Time is needed for the instructor to arrange to get machines at least two months in advance for him to check them for needed repairs and adjustments, get those repairs and supplies on hand, and get the machine in his shop on the day it is needed.

6. Sufficient time allotment to the machinery repair course or courses so that each course could thoroughly cover one type of machine, with several of various representative manufacturers' machines of that type on the floor for complete overhauling.

7. The establishment of adequate record-keeping system to cover each machine worked on in regard to:

a) Description of machine

b) Name and address of owner

c) Date inspected and date owner has agreed to relinquish it for repairs

d) List of repairs needed and estimate of cost to the owner

e) List and cost of repairs actually performed in shop

f) Date machine was completed and checked by instructor

g) Date machine was returned to and paid for by owner

h) Names of students working on each machine and grade for each student

8. Organization of students into squads, assignments to machines, arrangement for instructional time to permit of:

a) Maximum student participation in dismantling and rebuilding the machine

b) A minimum of lecture

c) The optimum of demonstrations and individual instruction

9. There is a reluctance on the part of some college administration officials to include the teaching of shop skills in the curriculum. By including shop management phases on the vocational level and conducting our courses so as to promote the trainee's facility with written and oral English by means of composition type reports, plus demonstration practice: we feel that we are definitely raising this type of instruction onto the collegiate rather than the *trade school* level.

Some general problems in this type of teacher training are:

1. College equipment is generally superior in quality and quantity to that found in vocational agriculture shops. We make every attempt to base our training on the use of the commonest tools and such improvisations as the teacher in service will have to make in his own shop.

2. The in-service teacher must know how and where to order parts. Each trainee is instructed in inspection methods and makes a list of needed parts for the machine he is assigned to before starting work on it. To assist him in making this list we supply manufacturer's setup and instruction booklets, so-called *bogus* parts catalogs, buyer's guides for obsolete machines, and a list of all machinery dealers in Virginia classified as to make of machinery sold, parts stocks, wholesale or retail, and repair shop facilities.

3. Provision of references when needed for unfamiliar repairs or adjustments. For these references we provide the repair books and service manuals furnished us by such manufacturers as Harry Ferguson, Inc., Deere and Co., International Harvester Co., and others. Wall charts furnished by these companies are also excellent. In addition, college bulletins and textbooks complete the list of references.

To summarize very briefly our experience for the past two years in training teachers and prospective teachers of vocational agriculture in machinery repair:

1. Unless we know the background of experience, technical knowledge, and skills of the trainee we are inclined to take too much for granted.

2. The itinerant training is perhaps the most effective for the individual teacher, provided a good machinery clinic day is organized by him for the day of the teacher-trainer visitation. The resident college teaching is the most efficient use of the teacher-trainer's time, though sufficient itinerant training should be done by each teacher trainer to keep in touch with changing conditions at the secondary school level.

3. If sufficient time can be allotted, the most effective college training is course building around each specific machine. Lacking the necessary time, we believe the mowing machine presents the maximum accumulation of repair skills with the minimum of common labor requirements and has the added advantage of being a machine that is readily available for repairs in most sections of the country. The bulk of our instruction is built around mower care, repair, and adjustment; supplemented by plows, cultivators, harrows, grain drills, and grain binders.

4. Thorough and detailed preparation for a machinery repair course is essential if the trainee is to get the maximum benefit from the limited time which he can spend in such instruction.

5. By operating a farmers' machinery repair course in the college shops under the Food Production War-Training Program we provide ourselves with a first-hand method of keeping in direct touch with the problems of the teacher of vocational agriculture in this field. It is only by understanding his problems that we can build a curriculum of teacher training which will prepare him to adequately meet them.

When you incline to have new clothes, look first well over the old ones, and see if you cannot shift with them another year, either by scouring, mending, or even patching if necessary. Remember a patch on your coat and money in your pocket is better and more creditable, than a writ on your back and no money to take it off. — *Benjamin Franklin.*

Aviation Moves In

GEORGE H. PARKES*

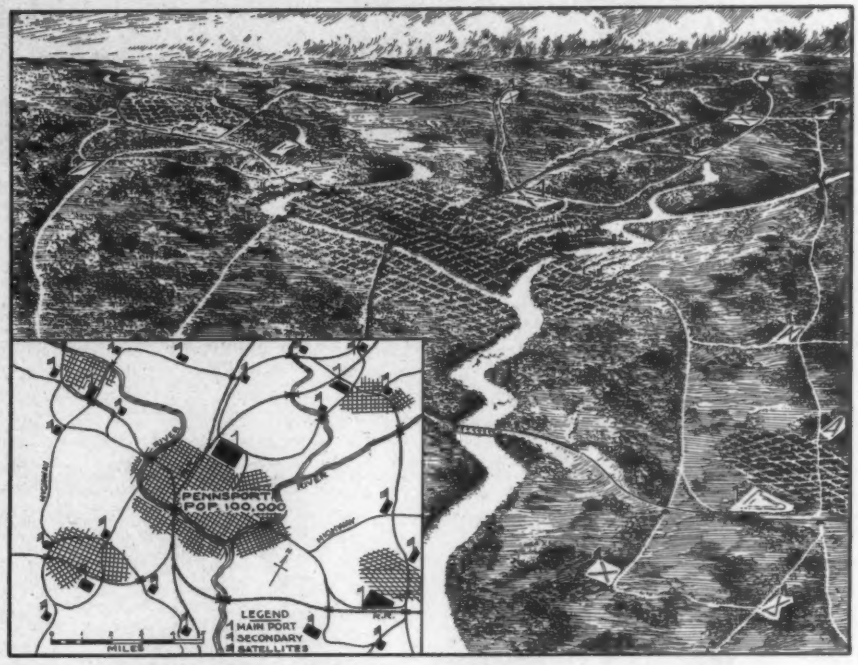
The alert vocational school staff is giving thought to the now unleashed economic and social force of aviation. We are to be the greatest air power in the world, in war and in peace. We have finished thinking of the airplane as a strange mechanism supported on thin air by a romantic and fragile magic and ready to fall and injure its occupants at the least mishap. Instead, we are taking on the point of view of youth — the true aeronauts. We see the aircraft as a strong and beautiful machine, swimming in a sea of fluid, under well-ordered natural laws. It is as safe as an automobile on a pavement, providing only that we understand these laws and obey them.

If aviation is to have the predicted influence on our economy, it is our duty as education planners to get ready. In aviation, as in other occupational fields, a man-power problem five years hence is on our doorstep today. In this field we must do some unusually farsighted planning. Many progressive and alert groups and agencies are awake to the future of aviation education, and some of them have a head start on us. We have a job to do in aviation, and we must stake out our claim.

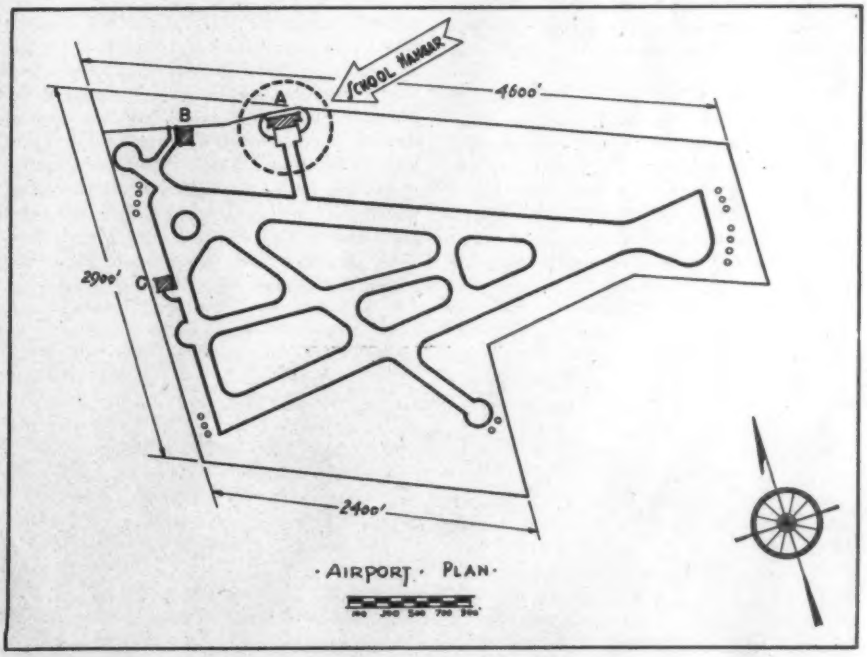
The first obligation of the vocational staff is to get an airport outlet. Time is the essence of the contract. Wide-awake industries, municipalities, and business groups see in the local airport a transportation and business outlet not unlike a navigable stream in older days or a great highway or railway now. With air express and air freight cheaper and better than most other forms of communication, with the certain prospect that much first-class mail and passenger travel will be by air, and the shrinking distance from factory to market by air, there is a general movement to obtain locations on this new highway. The aviation school must be on the new highway too.

While airports are being purchased and planned against our postwar air traffic, the vocational school should obtain land, leased or purchased, for future school construction. This is as elementary as the practice of obtaining cheap school sites for the future construction of school buildings in a developing residential area.

The vocational aviation program of the future must have its principal location at an airport. It is as important to plan for an airport outlet as it is to have the automobile school open onto the street. Young people are going to use airplanes. They are going to handle them, and they are going to fly them. The aircraft mechanic who does not fly, at least as a passenger, is as poorly equipped for his work as an automobile mechanic who cannot drive, or the steel rigger who cannot go aloft. The instrument man, the aircraft radio technician, the follower of a hundred airport occupations, must have his final training at least where live aircraft can fly. In aviation as with other industries, we learn to

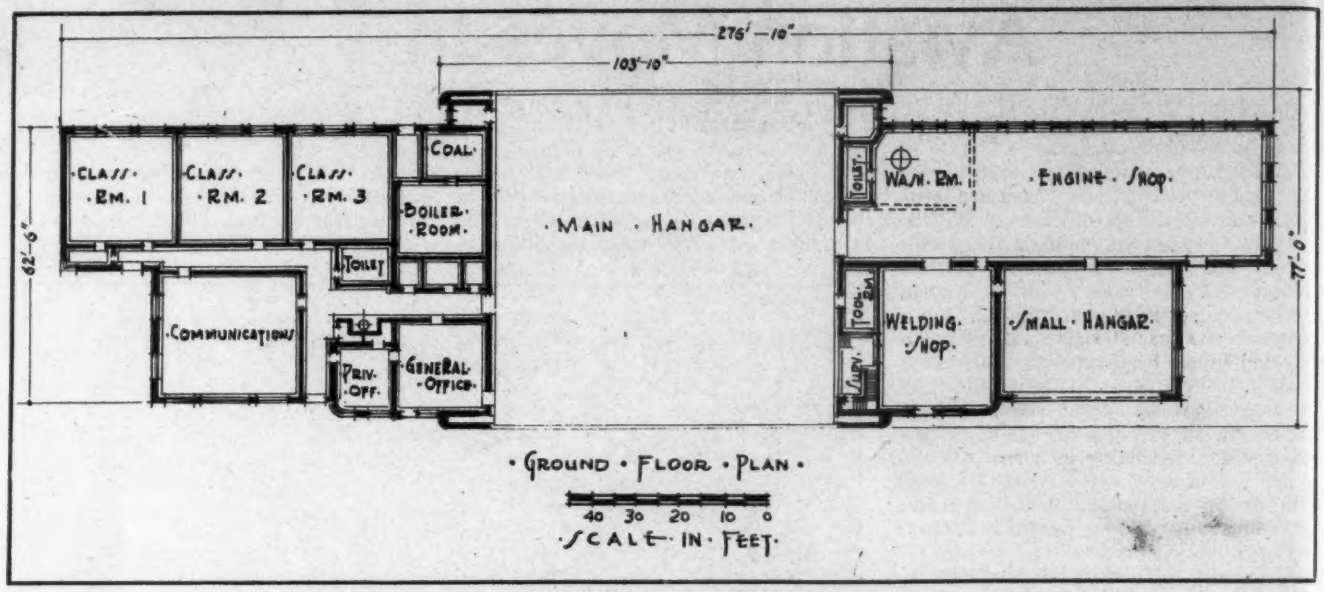


A community and its airports. Schools should have their buildings preferably on satellite or on secondary fields



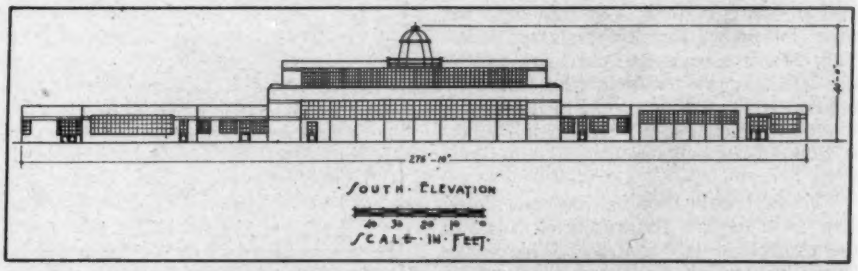
Airport plan
— D. H. Grootenboer, Registered Architect, Williamsport, Pa.

*Director, Williamsport Technical Institute, Williamsport, Pa.



Floor plan of Vocational School airport building

— D. H. Grootenboer, Registered Architect, Williamsport, Pa.



Elevation of Vocational School airport building

— D. H. Grootenboer, Registered Architect, Williamsport, Pa.

do by doing, and we train on useful and productive jobs.

In getting ready for the future airport vocational school, the vocational staff should carefully study trends in this rapidly moving industry. In selecting a location for the airport school, it is important to note that student flying and practice work of other types may be discouraged on the major airport of the future. Already the enthusiastic model builders have been barred from busy fields as a safety measure. Prior to the curtailment of much civilian flying in critical war areas at the opening of hostilities, some fifty airports in the East were closed to civilian training to give greater freedom to transport and military aircraft.

The best location for the vocational aviation school of the future seems to be on what is known as a *satellite* airport. This is one of a number of small airports located five or ten miles from the major airport, where light planes and experimental and educational programs may take place without undue risk to the heavier equipment at the chief airport. Vocational schools would do well to join with industries, municipalities, and private schools in locating future satellite fields and getting long-term leases and options, or by actually purchasing land. No new airport should be laid out without reserving a site for the local vocational school hangar.

In this long-term educational planning, which may not be so long as we now surmise, the school should keep in mind suitable facilities for the model fliers, the glider fliers, and the approved repair station. The model fliers must have an area well removed from the runways for powered aircraft, and the glider enthusiasts must have terrain which is suitable for both gliding and soaring.

The approved repair station in aviation corresponds to the service garage in the automotive field. Some vocational schools now maintain such approved repair stations as a final training ground for aircraft mechanics. Approved repair stations are licensed by the Civil Aeronautics Authority under rigid but sensible regulations which are designed to safeguard the flying public. These establishments must be manned by instructors who are licensed mechanics and the student groups must be carefully selected and very small, not over six advanced students to each instructor. The approved repair station may be on the satellite field or at the main airport, depending upon the amount of traffic. It must be located where aircraft can be flown to it for repair.

Central portion of school hangar

Flight Training

In selecting an airport outlet, the school staff should keep in mind that vocational school students are going to fly, and in the not too distant future, vocational flying

will be a regular part of the all day unit trade and trade extension program in areas of aeronautical employment. It is true that today there is an official taboo on vocational flight instruction. Not one organized vocational flying class exists in the United States, but this will change and youth will fly and schools will teach them.

The Area School

Vocational aviation training will develop on an area basis. The cost of instruction, equipment, and buildings will force the pooling of resources of neighboring communities, and possibly several agencies. Present estimates call for an expenditure of at least $300 per student year for serious aviation training, and the cost will be greater if out-of-town students must be maintained at public expense. Maintenance at public expense is the only sure way of securing an equal educational opportunity in this field for the youth in the rural areas of our country.

The Individual Progression of Students in General Shop Subjects

G. H. SILVIUS*

The general shop is now recognized as one in which two or more activities are carried on simultaneously. The work stations in the shop are usually arranged by departments so that each of the activities can be carried on in a definite area of the room. The assignment and roll call board described in this article has proved to be an effective device for assigning students to work stations in the different areas of the shop.

The Disadvantages of Group Rotation

In many sections of the country the practice has been to rotate groups. Students are assigned to a group which is rotated at a definite time during the term. For example, if three activities are carried on simultaneously, woodworking, electrical, and metalworking, and the course is 18 weeks in length, the groups are moved every 6 weeks; the pupils who were working in the electrical department for the first 6 weeks may be moved to the woodworking work stations, the pupils in the woodworking activity to the metal stations, and the metalworkers to the electrical department. Everyone changes at the end of the sixth and again at the completion of the twelfth week.

We know that no two students work at the same rate and even if they were expected to make the same projects, it would be impossible for them all to finish their work in an activity on exactly the same day. When group rotation is used, the students with unfinished work at the time of the grand change present a real problem. Usually the conscientious teacher makes arrangements for the pupils to come in after school so that they can complete the work. In many cases, the work is simply left unfinished. Educators are agreed that it is important that a student finish every job that is undertaken. Probably the most serious objection to this plan is that the jobs must be highly standardized. One can readily see that the teacher could not encourage the pupil to develop projects that would meet his own needs or he would soon find that a pupil would just be under way on the development of a project when it would be necessary for him to move and give up the work station to another person being assigned to that area of the shop.

We are fortunate in industrial education to be able to maintain a program on an individual basis, where every member of the class moves ahead, solving his own problems, at his own rate. Every effort should be made to organize the work so that it is not necessary to have students move along in step with each other.

Individual Progression Used in Detroit

The operating scheme used in general shop subjects in the Detroit schools is to rotate students individually from one department to another. A student may start in any department where there is a vacant work station; he remains there until his work is completed and is then reassigned to another area in the shop where there is an open work station. Several advantages are given for the plan of individual progression:

1. A student completes each project before he starts another job.
2. Students are handled individually and not as a group.
3. The teacher can encourage students to work out personal projects, change the design of core jobs, and develop projects that meet their needs, since he is not concerned about having several pupils finish their work at a specified date.
4. The students progress at their own rate of speed and are not subjected to undue pressure to finish work by a certain date.
5. The demonstrations based on the typical projects can be given to the entire class at one time.
6. It is helpful for pupils to see the typical projects under way in the many stages of construction.

The Assignment and Roll Call Board

The assignment and roll call board is mounted on the wall near the door of the shop so that it is convenient for students to walk by it as they report to the shop at the beginning of the period. Each student is asked to remove the brass check with his shop number and hang it on the hook, which represents his work station at that time. In shops where this device is used, the roll is automatically taken and the students indicate their work stations before the tardy bell is rung. This device appeals to students because it takes the place of calling the roll and increases the length of the work period; it is completely handled by the student officers.

Figure 1 shows the assignment board that was worked out for a household mechanics shop. The principle of this device, however, can be applied in any general shop subject.

Section A of this device consists of 12 hooks numbered consecutively from 1 through 12, which represent the work stations in the woodworking department.

Section B of the board is for the hooks which represent the work stations in the metalworking area of the shop. They are numbered from 13 through 24.

Section C represents the work stations for electrical work and the hooks are numbered from 25 through 36.

Section D is for the work stations in the general department. Such activities as glazing, care of doors and windows, plumbing, care of tools, and finishing, are done at these work stations.

Section E is for the full-time officers in the student personnel.

Section F is for students who are planning work and are not using the work stations in the shop.

Section G is placed at the bottom of the board with as many hooks as is necessary for the largest class that comes to the

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shop; the hooks are numbered consecutively. Brass checks are also numbered and hung on these hooks. Each student finds his brass check in this section of the board as he enters the room, at the beginning of the period. The number on his brass check *is his shop number*. When he reports, he removes his brass check from section G, and hangs it on the hook that represents the work station to which he is assigned. The record clerk puts all of the brass checks back in section G of the board ten minutes before the end of each period.

The Shop Number

Early in the term, each student is assigned a shop number. This number is used throughout the organization of the shop. It is stenciled on the instruction seat in which he sits. The student finds it on his shop locker. He uses it when checking out tools, finding his name on the progress chart, and on his *Planning Book*.[1] He uses the brass check with his shop number at the assignment and roll call board.

The Work Station

A work station consists of a place where a student can make his headquarters while he is doing a particular job. Usually, it is a worktable or bench where the necessary tools and materials can be assembled for doing the work. If the teacher refrains from mounting too much permanent equipment on work stations, they may be used for more than one kind of work. For example, the work stations in an electrical department might be used for leatherworking or work with plastics by another class, or later in the term by the same class, if the tops of the work station are kept clear. Most devices, tools, and equipment can be stored so that they can be moved to a work station when they are needed. Such equipment as the tool grinder, the soldering furnaces, and the squaring shears should be considered as neutral equipment and not be numbered as work stations. A student should leave his work station and go to this equipment as he uses it. The work stations are numbered and grouped together by departments. The numbers stenciled on each station are represented by hooks on the assignment board. See Figure 2.

The Assignment Board in Operation

When a student is ready to start a new job, he looks at the board to determine where there are vacant work stations. Any hook without a brass check indicates that the work station is open. In the corner of each plan of work sheet for each project, there is a place for:

Teacher's Approval to Start Work ——
Work Station Number ——
Assigned by Foreman ——

After the student determines that there is an open work station in the department in which he is interested, he asks the teacher to approve his "Plan of Work." Then he asks the foreman of that particular department to sign his name and give him the work station in his area. The foreman moves the student's check to the hook representing the work station assigned.

At the beginning of each shop period when a boy comes into the room, he takes the check with his shop number and hangs it on the hook that represents his work station. For example, if Ralph Stone's shop number is 10, and he is working on bench 12 in the woodworking department, he takes check No. 10 and hangs it on hook No. 12 in section A. He continues to hang his check on hook No. 12 until the job is completed and he is reassigned.

The brass checks that are not moved, after the students have reported at the board, indicate the shop numbers of the students who are absent. The record clerk makes a list of the absentees from these checks.

The number of checks hung on the hooks in any one department represent the number of students assigned to that activity at the time. The hooks that do not have checks on them are work stations that are available for assignment to students entering the department.

Work stations assigned to students who are absent automatically become available for reassignment. This eliminates one of the big problems that usually arises when it is necessary to make the maximum use of the work stations.

Section E of the board is for the full-

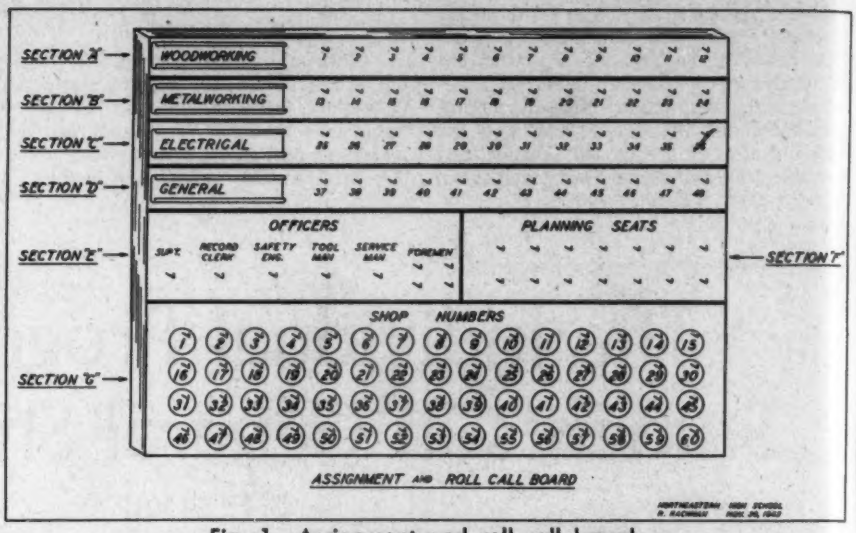

Fig. 1. Assignment and roll call board

Fig. 2. The number stenciled on the work station is represented on the assignment board with a hook

Fig. 3. Students report at the assigment and roll call board as soon as they enter the room

[1]Gerald Baysinger and G. H. Silvius, *The Student Planning Book for Industrial Arts and Vocational Classes*, International Textbook Co., 2nd Edition, 1943.

time officers; it is not necessary for them to have a work station while they are on duty. When a boy is superintendent, he hangs his check on the hook designated for this job.

Students who are planning work hang their checks in section F on the board. A few minutes before the end of the class period, it is the duty of one of the class officers to remove the checks from the work station hooks and rearrange them in consecutive order in section G for the incoming class.

Advantages of the Assignment and Roll Call Board

The following problems are solved by this device:

1. A plan is provided for individual progression of students in general shop subjects.
2. No teacher effort is required to operate the device.
3. It helps to vitalize the pupil personnel organization.
4. Roll call is taken automatically and the working time is increased.
5. A worth-while activity is taking place during the time between classes.
6. Students are assigned a definite place to work in a department.
7. Clerical work is reduced to a minimum.
8. Work stations not in use are always available for assignment.
9. The departments can easily be balanced because the number of students in each department is easily detected.

Photographic Aids for the Vocational Teacher

RICHARD H. BEHRENS*

Recent advances in the development and manufacture of inexpensive but efficient cameras, and in the production of films and photographic papers of high speed and wide latitude, have placed in the hands of the vocational teacher an easy means of producing his own visual material. Such teacher-prepared visual aids, while sometimes lacking the refinements of those obtainable from professional sources, often have the advantage of being more adaptable to the instructor's specific teaching situation.

The sheet-metal teacher, for example, might to a considerable extent find advantages in using a short motion-picture film showing the details of making a particular metal seam. Ordinarily the teacher might first take a small group of pupils about a machine and demonstrate the various operations involved in doing the job. A motion picture, taken under favorable lighting conditions, projected on a screen highly magnified and in slow motion, could in such a case visualize the operations analytically, not only for a group but for a whole class. While films of this nature covering many shop fields are available through visual centers, they are not always obtainable when most needed, often involve rental charges which, when many are used, may run to considerable sums. Quite frequently, too, they fail to tie the operations illustrated to the specific machines and shop conditions found in the school. The production of such a film by the shop teacher in his own shop presents no great problem either in learning the technique of production or in cost, since satisfactory films may be produced in the 16mm. size ready for projection for a little over 1 cent per foot.

Some experimenting with cameras, films, and printing would be necessary on the part of the less experienced teacher-photographer before completely satisfactory results might be obtained. The vocational teacher, however, who is practiced in the mechanical arts, need not look for serious obstacles in the production of valuable visual aids.

Types of Photographic Aids

The photographic print on paper is one of the simplest forms of photographic visual aids. The importance of the flat photograph as a means of presenting graphic material is testified to by the increasing use of photographic cuts in textbooks. For the vocational teacher these may be useful as single prints or as a series of pictures showing the progression on a job or of steps in the manufacture of some material of construction. Mounted on stiff board they may serve as instruction sheets to illustrate a tool, a machine, or an operation. Used in a series, accompanied by written directions, they are valuable timesaving teaching aids since they make clear the exact position of the worker, the tool, and the material on any given job. Used for instruction of classes and groups these prints should, for good visibility, be at least 5 by 7 in. in dimension, printed preferably on glossy paper, and mounted on a stiff board. Such individual prints may be contact prints or they may be the result of enlarging smaller negatives. Prints may be mounted, framed, or fastened to the wall so that students can refer to them at all times. They may also be filed in a simple case from which they can be removed in any sequence. Enlarged prints used with a class have the advantage of presenting graphic material without benefit of projectors, darkened rooms, or previous preparation. A printshop instructor might, in the interest of teaching his pupils the characteristics of a particular type font; find an enlarged photograph of a particular kind or type very useful. A related science instructor might find an enlarged microscopic picture of a sectioned piece of wood very useful in explaining the structure of wood. Photographs of this type may easily be numbered, outlined, or lettered for better definition by the use of India ink on the printed surface.

The use of pictorial strips to show a series of operations in conjunction with instruction sheets requires the use of pictures in sizes like 2¼ by 3¼ or 3¼ by 4¼ in. Occasionally even smaller prints may be used if the image is large enough to be readily seen. Glossy prints are more desirable in the smaller size, since most matte surfaces lack the clarity found in the squeegeed print. Mounted pictures may be lacquered with clear lacquer to avoid soiling in use.

Paper prints may be made from the photographic negative by contact or by projection in an enlarger. Contact printing is the simpler method, requiring only some form of printing frame or box with which to hold the negative and the paper in close contact and a minimum of darkroom equipment and facilities. Contact prints are always the sharpest which may be obtained from a negative, although the use of a good enlarger with reasonable care in focusing leaves little to be desired in the way of sharp pictures. Contact prints suffer from the disadvantage of permitting only one size picture to be made. Printing by projection from an enlarger, while not as rapid as the average contact printing process, can be carried out with considerable speed with modern amateur photographic equipment.

The latitude of the various brands of projection paper is now so great that the beginning photographer need not hesitate to attempt photographic enlarging. Enlarging negatives requires the use of one of the considerable varieties of enlargers. These are usually equipped with rapid anastigmat lenses and are relatively inexpensive as photographic equipment goes. The mechanically minded photographer may even make a satisfactory enlarger without much difficulty. The disadvantage of the enlarging process lies in the fact that this operation must be carried out in orange-red light and requires more care than does the contact printing process. The advantage of the print made by projection lies in the flexibility of size and the control over the finished print. By the processes of dodging, and, where modern

*Berkeley, Calif.

tilting lens boards are available in the enlarger, the corrections of distortions and perspectives and deficiencies in the negative may be corrected. The enlarger also permits the use of the miniature camera negative, which, if properly handled, is a great economy in the cost of film.

A particularly effective method of presenting visual material to groups and classes is through the use of slides and transparencies. These differ from paper prints in that the positive image is printed, photographically, on an emulsion coated on transparent glass or film and projected upon a screen by means of a still projector. Of these there are two sizes in common use in the United States, one taking slides 3¼ by 4 in. in size and the other 2 by 2 in. Film strips, containing a considerable number of pictures, are also extensively used. Projections from transparencies present the picture in large size in this way avoiding any straining of the eyes. They also possess greater tonal range in the projections than do paper prints. Color transparencies add another feature which helps greatly in subjects where color is a vital element.

The standard 3¼ by 4-in. slides, printed upon glass coated with a photographic emulsion similar to that used on enlarging papers, has been and is still extensively used for instructional purposes. These slides have been so extensively used that few will have failed to appreciate their possibilities for use in the schoolroom. These slides may be printed by contact with the negative, just as paper prints are made, or they may be printed by projection by means of an enlarger, in this way enabling the maker to use films both smaller and larger than the slide. Projection printing also permits a portion of a negative to be used to cover the full slide. More recently the 2 by 2-in. slide has come into extensive use, due in part to the possibilities of obtaining at reasonable prices natural color transparencies of great fidelity. Glass slides and film positives bound between glass may be made in the 2 by 2-in. size by contact or by the enlargement or reduction of negatives ranging from the 35mm. size to 5 by 7 in. or larger. The economy and ease with which the smaller size slides may be handled as well as the small size of the projector necessary to handle them has secured for this size slide an increasing use. The film strip, consisting of a sequence of pictures printed on a continuous film, is recommended for its compactness, its unbreakable character, and its economy. The difficulty of producing uniform prints on such a strip from a variety of amateur negatives makes the film strip less simple to produce unless great care is exercised in securing uniform negatives.

The slide or film strip demands the use of a darkened room for its projection before a class or group. It permits the use of a pointer by the instructor and also tends to focus attention on the brightly lighted screen. A considerable advantage of still projections lies in the fact that all types of pictures, those prepared from the original negative or copies of cuts or drawings, may be used interchangeably in any sequence. One small slide may serve a whole class. The vocational-shop teacher and the related-subjects teacher can build up a large library of slides to serve any special instructional purposes and these, in addition to those available through other sources, serve as a valuable aid in teaching groups and classes as a whole.

Motion Pictures

Paper prints and slide projections, however valuable as adjuncts to the teaching process, often fail fully to justify their use when compared to the use of motion pictures. Motion-picture sizes in common use range from 35mm. in width down to 8mm. Because of the expense involved in the production of the 35mm. film, its use in schools has fallen off greatly in the past few years. Although 8mm. film is extensively used by the amateur and is well adapted to projection for smaller groups in the schoolroom, the size which is most universally used for school projections is the 16mm. width.

The 16mm. motion-picture camera, obtainable at astonishingly low cost, is often a very versatile instrument, permitting the use of slow-motion speeds, and often the means of making animated pictures from drawings. The advantage of the variable speeds lies in the ability of the camera to depict operations in slow motion which enables the learner to see them analytically.

Films for projection in both the 16mm. and 8mm. sizes may be made from a negative film exposed in the camera by printing upon a positive film. Most amateur projection films are obtained by a process of darkroom reversal which does not require that a print be made, the original film serving both as negative and positive.

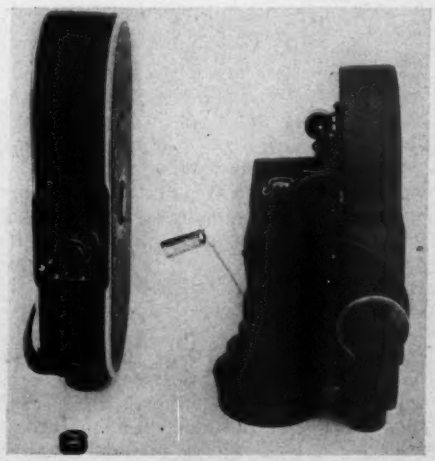

Fig. 1. Two 16mm. motion picture cameras. Fixed focus variety with single speed on the left. Camera on the right is 16mm. with 5 speeds and cranking mechanism. Supplemental lens for fixed focus camera in foreground

Both 16mm. and 8mm. film is sold to the amateur with the processing service included. After the film is exposed it is mailed to the nearest processing station from which it will, in the course of a few days, be returned ready for projection. By the use of cheap positive film, developed by the photographer in a relatively simple apparatus, the cost of 16mm. film may be reduced to a very small figure. Such film, while suffering from lack of speed, color blindness, and halation, may still be made to produce satisfactory results for instructional purposes for little more than 1 cent per foot.

Camera Types

Still picture cameras currently made and sold to the amateur photographer may be roughly classified into three categories, the ordinary roll film hand camera of picture size 2¼ by 3¼ in. or larger, intended for the casual snapshot, the miniature camera, which now seems to include all sizes making pictures less than 2¼ by 3¼ in., and the plate or cut-film type camera which is often used by the more advanced amateur photographer. Of these cameras the first is of the least value to the teacher intending to do his own photographic work and the last two, depending upon equipment, are the most valuable. The ordinary roll film camera may, with the use of supplementary lenses, be made to serve while the larger film-back camera provides the means of getting any type of picture desired with the greatest ease. Such cameras are usually equipped with a ground-glass back and a double bellows which permits pictures to be focused and taken in original size. In the interest of economy and convenience the miniature camera, particularly that using 35mm. motion-picture film, is of the greatest use to the teacher who may wish to take original photographs, make copies from books and charts, and who may wish not only to make paper prints but film strips and slides for projection. Satisfactory and versatile miniature cameras may often be purchased at prices below $25 and with the expenditure of a few dollars more, copying lenses and stands may be added to enable the user to take large size images on the film. More expensive miniature cameras provide lenses with greater accuracy, and a wealth of supplementary equipment. These enable the user to perform photographic feats unthought of a generation ago. A miniature camera with an excellent corrected lens and with precision made mechanism will yield very sharp pictures at high magnifications and may provide a greater variety of shutter speeds than will a less expensive camera; yet it will differ little from the latter in the possibilities for securing satisfactory visual material. The economy of these miniature cameras lies in the fact that the relatively inexpensive 35mm. motion-picture film may be used. Where the user loads his own film carriers and purchases his own film in the bulk rolls, the cost of the negative material per picture may be distinctly less than 1 cent

apiece. A great variety of film is also obtainable ranging from exceedingly slow and contrasty film, often with great resolving power, to exceedingly fast film having considerable latitude and resolving capacity. The convenience of the miniature camera lies in its great depth of focus, which permits pictures to be taken sharply in considerable depth, its small size, which makes for ease in handling, and the fact that film may be printed by contact to make slides and film strips.

Focusing cameras with ground glass backs, double bellows, and provisions for using cut-film or glass plates enable the photographer to secure larger prints by contact and more accurately focused and composed pictures. Films ranging from those intended for use with infrared light to those sensitive only to ultra-violet or blue light are readily available to the owners of such cameras. Roll film cameras do not permit the use of such a variety of film emulsions. Single pictures may be taken and immediately developed when the plate-back camera is used. Although roll films may be separated and individual pictures developed, an elaborate cutting process is necessary. The larger size film also permits of satisfactory contact prints, and enlargements from these film are easier to produce since smaller enlargements only are required. With the proper enlarging lenses slides may be made from larger negatives with the average projection printer.

Fig. 2. Three 35mm. cameras with metal film holder and supplementary lenses in the foreground

A modification of the focusing camera with the ground glass back is the reflex camera which permits of focusing on a hooded and conveniently arranged piece of ground glass. The image is in this way brought into a horizontal plane by means of a separate finder lens or by means of a mirror which throws the image from the camera lens upon the ground glass.

Cameras used for taking the amateur 8 and 16mm. size motion pictures are of two types: those taking rolls of film and those requiring rolls mounted in magazines. Of the two the roll film camera is the most economical to operate and the magazine type the most convenient. The convenience of the magazine camera lies in the fact that in the course of a few seconds one magazine may be removed and replaced with color film or with a magazine containing faster or slower film. The least expensive motion-picture camera is the fixed focus variety in which the principle of *universal focus* takes care of the focusing problem. These cameras are usually set to run at one speed — the speed at which the film is to be projected. Amateur motion-picture cameras which run at a variety of speeds such as 8, 16, 24, 32, 64, 72, or 128 frames per second can be purchased at somewhat higher prices than the fixed speed models. The advantage of varying speeds lies in the slow motion effect obtainable during projection at the rate of 16 frames per second. Action photographed at increased speeds can, therefore, be followed more closely when projected. With the short focal length lenses commonly used on motion-picture cameras focusing allows of picture taking at distances of a few inches to infinity. Some of the medium priced amateur cameras have a crank attachment which permits the taking of animated drawing pictures.

Fig. 3. View camera and folding reflex camera

Supplementary Camera Equipment

Next to the camera itself the exposure meter is of the utmost importance in insuring correctly exposed pictures. The most simple of these depend upon an optical wedge through which the lighting of the scene to be photographed is viewed to determine exposure. Another type is a comparison meter which compares a filtered colored light produced by the scene to be photographed with a standard light. One of the most reliable is the photoelectric cell type which objectively measures the intensity of light reflected from a scene to be photographed. All of these will produce satisfactory exposures if intelligently used.

Supplementary lenses which may be attached to the regular lens equipment are an inexpensive but valuable adjunct to the camera. With these copy work, wide-angle pictures, and telescopic views may be photographed. Filters of well over a hundred varieties are obtainable and these enable the photographer to obtain unusual effects which should, by emphasizing certain colors, enhance the educational value of pictures made with them.

A sturdy tripod for holding the camera, preferably one with a tilting and revolving head, is almost a necessity to the serious photographer.

Darkrooms and Their Equipment

Darkroom equipment for the amateur photographer has been produced in such variety and perfection that most of the photographic operations may now be carried on without benefit of a darkroom. While the darkroom has definite advantages, bathrooms and kitchens can, particularly at night, be pressed into use as temporary darkrooms. Devices like that shown in Figure 5 make it possible to carry on all of the operations such as loading film holders or developing tanks in broad daylight.

Enlargers equipped with anastigmat lenses are now available to the nonprofessional photographer at prices approximately equal to that of the less expensive varieties of cameras. Two types are in common use, those having light reflector illumination and those equipped with condensers. The latter type are largely used on the miniature film enlargers, since they produce sharper images than the more diffused reflector type. Enlargers intended for use with negatives 4 by 5 in. or larger are not well adapted to the enlargement of miniature sizes. The photographic literature is replete with designs for inexpensive enlargers which may often be made by the photographer.

Of considerable value to the teacher-photographer is some form of copy frame which may be used to support a camera

Fig. 4. Two types of photoelectric exposure meters

and the subject to be copied. Such a shop-made frame, intended for use with a miniature camera, is illustrated in Figure 6. It consists of a wooden base to which was attached with a pipe flange a 24-in. piece of ¾-in. pipe. A slide equipped with a set-screw to which the camera may be fastened provides a means of adjusting the camera in relation to the subject to be copied. The miniature camera shown in the illustration is equipped with three supplementary lenses which permit filling the negative with an object 5 by 8 in. in size. This stand with sheet-metal reflectors for lighting makes possible the easy copying of drawings and illustrations as well as small objects at close range.

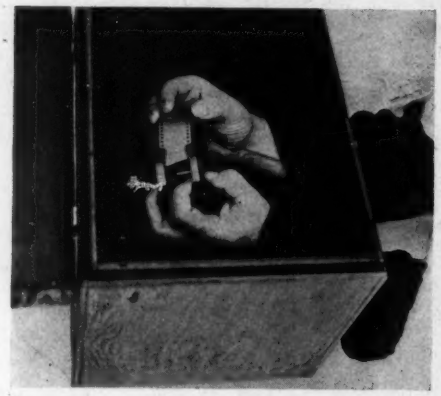

Fig. 5. Darkroom box with lid open. A box substitute for a darkroom. Film may be loaded into holders or tanks safely in this device

Contact printing of pictures may be carried out in an inexpensive printing frame or some form of printing box. Two of such boxes are shown in Figure 7. The larger of these consists of a simple box containing two 25-watt lamps and a small wattage red bulb. A cover of glass and a hinged felted wooden cover completes the box. The smaller open end box is made in a

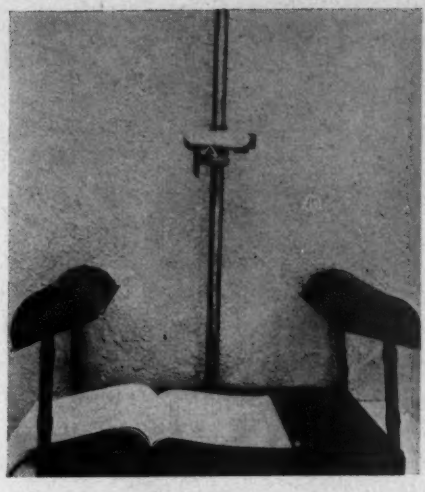

Fig. 6. Copying frame with adjustable lamp reflectors and miniature camera attached to slide support

similar manner, and is used for printing from 35mm. film. Both paper and lantern slide prints may be made with these printing boxes.

Motion pictures may be developed and reversed for projection by means of the drum and tray equipment shown in Figure 8. While inexpensive wooden drums and trays may be purchased for this purpose, they may also be made on the basis of designs found in various texts and articles devoted to the development of motion-picture film. The developing unit in Figure 8 was made in a high school sheet-metal shop of stainless steel. It is large enough to develop 50 ft. of 16mm. film at a time. In this apparatus development and reversal may be carried out with as little as a quart and a half of liquid.

Photographic Film

Negative film stocks with a great variety of characteristics is available through various film manufacturers. Some of these are best when used to photograph subjects of low contrasts, while other films are best used on those of high contrast. Special negative stocks are used for high speed photography, while some with a narrow tonal range are used when line drawings are to be copied. Special films for infrared and color photography are well-known examples of the range of emulsions available to the amateur photographer. Many photographers utilize one film for all purposes and often obtain satisfactory results by modifications of darkroom techniques, such as development and selection of printing papers. For the vocational teacher who wishes to take pictures for reproduction

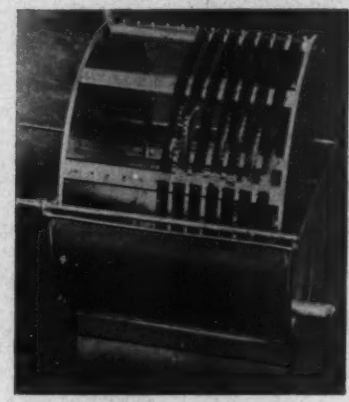

Fig. 8. Motion picture developing tank and reel

and where the maximum clarity is desired, two or three types of film will serve nicely. For the average picture the cheaper, fine-grained, orthochromatic film, which may be handled in faint red light in the darkroom, serves as a very satisfactory film. Where color corrections are important and where contrast filters are to be used, a film sensitive to all colors, such as panchromatic film, is desirable. The slower vari-

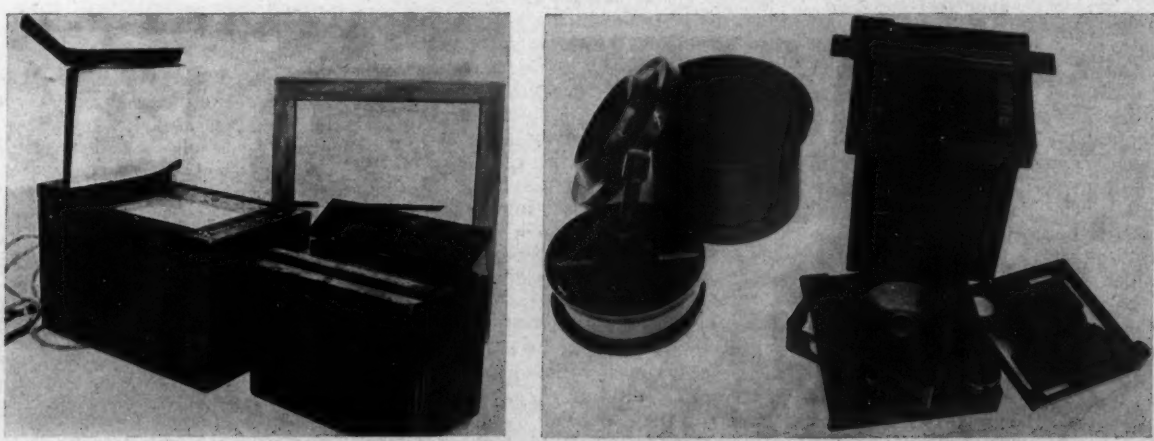

Fig. 7. Two shop-made contact printers. One for film up to 5 by 7 in., in size and the other for miniature film. Large printing frame in background. Fig. 9. Adjustable roll-film and cut-film developing tanks

eties of these which are usually fine grained, and hence capable of being greatly enlarged without evidence of grain, are much to be desired for the average work which the teacher may be called upon to do.

Photographic papers are even more varied in their printing characteristics than are film. Two general types of paper are commonly used by the amateur photographer: contact and enlarging paper. For the preparation of prints for instructional purposes where clarity is the main objective, glossy paper which may be squeegeed to a high finish is desirable. The same may be said of the paper intended for enlarging. Occasionally photographic paper which may be folded without cracking the emulsion may be used.

A great variation in procedure in darkroom work characterizes the practice of photography by both the amateur and the professional. Every photographer has his pet developer which may be one recommended by a manufacturer of film or paper, or it may be one published in some prized book on photography. Undoubtedly the best formula and procedure to use in processing film and papers are those recommended by the manufacturer of the paper or film used. Developers and other photographic solutions may be made in small or large quantities from materials supplied by photographic manufacturers. The larger the package the more economically these solutions may be made. Such tubes or packages contain weighed proportions of chemicals which may be dissolved in a definite quantity of water and stored in bottles for use. Where considerable work is done, it is most economical to buy the individual chemicals required for the photographic solutions, weigh them out on a small balance, and prepare stock solutions.

The use of developers of various types has been rather well worked out and the specific directions for their use is almost always to be found in leaflets included in the packages of cut film or in the small booklets issued gratis or at small cost by the various photographic manufacturers. Advice on any phase of photography is easily obtained from the service departments of the various companies or through local camera stores whose owners and clerks are often themselves camera enthusiasts with a fund of information which they are quite willing to pass on as part of their stock in trade.

Much may be written on the various phases of photography which the vocational teacher would find useful to know were it not for the vast and easily understandable literature written for both the inexperienced and advanced amateur photographer. The market is so replete with excellent books, pamphlets, and periodicals filled with every manner of advice and instruction for the exposure and processing of film and paper and the building of photographic equipment that it would be difficult to do more than to suggest that the prospective teacher-photographer consult the magazine stand of his local photography store.

Teaching "First-Aid" Fire Control

DELBERT JOHNSON*

"Fire safety" is an inclusive term used to describe fire prevention *and* protection. Fire prevention, in its literal sense, means the elimination of fire hazards and the observance of safe practices. Familiar examples are the disposal of oil-soaked rags to prevent spontaneous ignition, and the storage of flammable liquids in safety cans to safeguard them from sparks and open flames. The principles of fire prevention usually are included in secondary, vocational, and trade school programs, particularly in connection with certain courses, such as shopwork.

Fire protection or control, on the other hand, has not figured as prominently in the average school curriculum. Fire safety authorities emphasize, however, the importance of teaching the principles of *first aid* fire control to everyone, and especially to those in, or about to enter, industry.

In industrial plants, there is usually a high degree of organization for fire emergencies. Rules exist for turning in alarms and for insuring the safety of workers not needed for fire fighting. In addition, trained departmental squads, the plant fire brigade, or both, are equipped to cope with fires of almost any size and to carry out salvage operations. In some plants, certain members of the fire-fighting organizations[1] are assigned to first-aid fire fighting. But in many plants, any worker on the spot is expected to attack a small fire.

Fortunately, the science of *first-aid* fire fighting falls well within the grasp and physical ability of the average high school student.

Fundamental to any program of instruction in incipient fire control are the following subjects: the different classes of fire, and how each one can be controlled; different types of extinguishers, how they operate, and the suitability of each for use on different kinds of fire; and precautions to be observed.[1]

There are three different classes of fire, each determined by what is burning. The most common kind is that which occurs in ordinary combustible materials — paper, wood, textiles, rubbish — and is designated by fire protection engineers as a "Class A" fire. Water is the best extinguishing agent for fires of this class.

Fires in flammable liquids — gasoline, oil, paint, etc. — form a second category, known as "Class B" fires. Fires in this class ordinarily require a smothering agent, such as foam or an inert gas or vapor, to cut off the oxygen supply. A stream of water might serve only to spread the flames.

The last class of fire — "Class C" — is that occurring in electrical equipment, such as motors or generators. Here, some agent must be used that will neither damage equipment nor provide a path for an electrical charge to pass from live equipment to the hose operator. Hence neither water nor chemicals dissolved in water should be used. What is needed is a nonconducting gas or vapor that will smother the flames without damaging equipment, or, if the voltage is high, without exposing the operator to danger.

With this background, the selection of "first-aid" equipment to use on any kind of fire becomes clear. Although fires in ordinary combustibles usually can be put out with any kind of approved extinguisher, water or water solution types are most effective. A small water hose or water bucket can be used also, but these makeshift substitutes have a number of disadvantages, among which are unwieldiness, their use for other purposes, the time it takes to get them into action, and the fact that they may bring the fire fighter too close to the fire.

Soda-acid, foam, gas cartridge, loaded stream, and pump tank extinguishers are standard types which contain either plain water or chemicals dissolved in water. All but the last named can be recognized by their tall, cylindrical outer shells and ring-top handles. Pump tanks have encased hand pumps.

Foam and loaded stream extinguishers are approved also for use on flammable liquid fires, as are vaporizing liquid (pump gun) and carbon dioxide (hornlike nozzle) entinguishers. The latter two, however, are the only ones suitable for use on electrical fires, since they are the only ones that contain no water. Vaporizing liquid extinguishers are operated by twisting the

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[1]More complete information on industrial fire fighting appears in the National Fire Protection Association training manual, *Industrial Fire Brigades.*

handle and pumping; carbon dioxide, by turning a valve.

When a fire is discovered, the first thing to do is to turn in an alarm. Then attack the fire with appropriate equipment. In industry, it is common practice to locate near various points of hazards the types of extinguishers which are suitable for the materials that may be involved in a fire.

If the fire is in ordinary combustible materials, take a position between the fire and an exit — to avoid being cut off by an unforeseen spread of the fire. Soda-acid or foam extinguishers can now be set in operation by inverting them; gas cartridge or loaded stream, by inverting them and bumping them on the ground; and pump tanks, by pumping. Stand where you will avoid inhaling the smoke and fire gases, and as far from the flames as effective use of the hose stream will permit. Aim at the base of what is burning — not at the smoke and flames. As soon as the fire is out, ventilate the area and investigate the charred remains. If glowing embers are found, give them a thorough drenching.

A fire in flammable liquids must be handled differently. Such a fire usually will occur either in a *spill* or in an open container of the liquid. Using a foam, vaporizing liquid, or carbon dioxide extinguisher on a spill fire, start at the end of the path of fire. If possible, stand with your back to the wind or draft. Apply the extinguishing agent with deliberate, sweeping motions, slowly walking up the path of the blaze. Be sure to put out every wisp of flame before moving forward.

To fight a fire in a container of burning liquid, if using a foam or vaporizing liquid extinguisher, aim at the far inside wall of the container just above the liquid level, so that the foam or vapor will fall back upon the float over the surface of the fire without splashing. If necessary, maneuver around the sides of the container to permit complete surface coverage in a minimum of time. All this, however, should take considerably less than a minute. When using a carbon dioxide extinguisher, hold the discharge end of the nozzle close to the burning surface, and move it slowly from side to side until the fire is out.

Students in the Saginaw, Mich., high school receive instruction in the chemistry of fire extinguishers. Here, a soda-acid type extinguisher is being recharged

In the case of an electrical fire, turn off the current, if possible, to prevent short-circuiting and accidental contact with live parts. Then apply the contents of a vaporizing liquid or carbon dioxide extinguisher at the base of what is burning. After the fire is out, continue application for a few seconds, so as to prevent a reflash.

Although much of this instruction can be carried out in the classroom with the aid of blackboard diagrams and exhibits, much more can be gained by supplementing this program with outdoor demonstrations and drills. If possible, invite a member of the fire department to demonstrate the operation of extinguishers, and then allow members of the class to try their skill. Ordinarily a *make-believe* fire, represented by a wooden box, provides an adequate target; however, under certain conditions and when fire department permission and supervision can be obtained, a small fire can be built in a safe place outdoors.

A good time to hold such a demonstration is just prior to the annual inspection of the school's extinguishers — since most types of extinguishers must be discharged anyway before they can be inspected. Then, when the demonstration is over, those students who are interested can be invited to watch recharge operations. A science teacher can explain some of the chemical principles involved.

Students should be encouraged also to read the information printed on the face of the extinguishers. Directions are given for operating and recharging. All approved extinguishers also carry an Underwriters' Laboratories label. This label indicates that the extinguisher has passed rigid performance tests, and that it can be considered reliable. The *UL* label also makes a note of the class or classes of fire for which the extinguisher is considered suitable. Thus, *A* indicates suitability for fires in ordinary combustible materials, *B* for those in flammable liquids, and *C* for those in electrical equipment. Another approval label that students will later encounter in industry is that of Factory Mutual Laboratories, indicated by an *FM* designation. One or both labels should appear on every extinguisher.

It is possible, of course, that the school is now equipped with what are known as *EAS* (Emergency Alternate Specifications) extinguishers. This *EAS* designation on an Underwriters' label indicates that the extinguisher bearing it has passed all standard performance tests, but, because it is made of substitute materials, cannot be expected to resist corrosion or stand up as long as standard approved models.

The place and degree of emphasis on *first-aid* fire-fighting instruction in the school curriculum must, of course, be determined by a number of local factors. Ideally, a school specializing in industrial and vocational subjects should have a separate course on fire safety, covering prevention and protection aspects in some detail. A complete course for fire guards, with the necessary training aids has been provided in the material published by the

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Students in the Metropolitan Vocational School in New York City study intricacies of auxiliary lighting systems for ships. Wall panel on the right exhibits various fixtures, each identified by a name plate. The vaporizing liquid extinguisher on the panel is handy for any accidental fires which may occur in electrical equipment

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

John J. Metz, Editor

The Salvage Problem and the School

Just at present the War Production Board is making great efforts to increase the amount of wastepaper salvaged throughout our country. Due to shortage of labor and other causes, the amount of pulpwood obtained from our forests has been reduced by millions of cords of lumber. At the same time, wrappings for ammunition, food, and lend-lease shipments call for the exportation of ever increasing amounts of paper products from which our paper mills cannot obtain any salvageable material with which to make up the reduction of the raw materials needed to produce paper. To make up for this double loss of basic materials for papermaking, the salvaging of every bit of wastepaper in the home, the office, and the factory is an imperative must.

The schools throughout the country have rendered excellent service in assisting to make the paper drives in their communities successful.

The Cleveland schools, for instance, are said to collect one thousand tons of paper per month. The Chicago elementary schools recently collected 400 tons of salvaged paper in one week. No doubt many other school systems can show equally fine records.

There are schools, however, where little is done to help this important effort to make available resources wherewith to assist our armed forces in this global war. The students, under the proper guidance, will lend their aid enthusiastically. The school should, of course, enlist the cooperation of the local salvage committee in order that the work of collecting and disposing of the wastepaper be done in the most efficient manner. The main thing is to have teachers and students see the necessity of doing their utmost to help in this necessary work of salvaging the lowly wastepaper.

But paper is not the only material that should be kept in mind when the question of salvage comes up for discussion. Metals of all kinds from the modest tin can up to the more aristocratic copper and bronze have to be considered and gathered and made available to the industries who need them for making the munitions of war.

Then there is still another phase of salvaging in which the schools have already helped, but in which they can do still more, and that is in the conservation of food. Clean plate clubs in the schools are not new, but a visit to any restaurant will convince anyone that there are still many children and adults who leave appreciable amounts of food on their plates to be returned to the kitchen, and eventually to the garbage can. Much of the food thus wasted would be welcomed by the starving peoples of Europe, Asia, and Africa. Many Americans are deploring the effects of rationing, yet these same people go to restaurants and waste food, and sad to say, these grownups have set up for themselves and their children the wrong idea that it is a mark of gentility not to eat all of the food that is served to them. Can the schools do something about it? Can the teachers themselves fight this silly custom by setting the right example for their students in the school cafeterias?

The W.P.B. again and again calls attention to the need for fats. Many families are doing a fine piece of salvaging work in this regard, but still too many take this phase of salvaging lightly. Can we make the pupils realize that the wasting of the smallest quantity of fat is inexcusable?

In what class should all of the incentives to gather the things needed for carrying on this war be specially emphasized? Should the duty of getting the youngsters salvage minded be entrusted to one person or should every teacher take over in his own classroom? Probably one person in charge of the activity is the best idea, but whichever way the solution of this problem is handled — increase the schools' participation in collecting all types of materials and thus help shorten the time required to gain the victory in this terrific global struggle.

Looking Ahead

It is true, the second semester of the present school year has just about started, yet it may be well to look ahead a few months to see what can be done for the older students who may need advice and guidance for the vacation months, from which we are not so far removed.

For instance, it is not too early to start working out a placement plan for Victory Farm Volunteers. This means that a tentative list of farmers who are willing to hire these volunteers must be made. Likewise, a list is needed of prospective workers who want to spend part or all of their vacation on the farm.

There always have been some city youths who have spent part of their vacations working on farms. Help of this type is not as reliable and as efficient as experienced adults, but they can do much to increase the food supply and reduce the shortage against which the country is continually being warned. The farmers, too, need to be told that they must do their part in training the young workers to become more efficient. Great patience is required in the training of these youngsters. They are not going to develop into experts overnight.

In these trying times of man-power shortage, all employers must learn the value of making the best of the labor supply at hand. The superior workers are no longer available; hence, an effort must be made to analyze the various jobs that have to be done and fit them to the youthful workers rather than expect inexperienced help to learn by themselves how best to do work for which they have had no training and no background.

Some agricultural teachers have done some very fine work along these lines with the 14 and 15 year olds in their schools. This, however, is true usually in the rural areas only. Under present conditions, boys and girls from the larger cities also find their way to the farms. Their own homes have not prepared them in any way for the work they wish to undertake. The school, therefore, must step in and do this preparatory work, both with the youth and with their probable employers.

In many cases provisions must be made to house the young workers in camps from which they go to the surrounding farms each morning. Under other conditions, the boys can find board and room with the farmers for whom they work. For all of these different situations the young must be conditioned and the school can do much, in the next few months, in preparing their students to engage in this very worth-while endeavor to help the American farmer to produce more food for consumption at home and at the front.

(Continued from page 154)

U. S. Office of Civilian Defense.

Lacking such a course, however, special programs can be arranged to coincide with *Cleanup* Week in the spring and *Fire Prevention* Week in the fall, at which times intensive work can be done along these lines; in this case, *follow-up* by teachers during the remainder of the year is very important. Finally, various aspects of fire safety can be worked into different courses, such as civics, health, physics, and so forth.

Instructional aids as well as additional information on all aspects of fire safety can be obtained by writing to the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass., and to the U. S. Office of Civilian Defense.

Problems and Projects

ORNAMENTAL TIN CRAFT

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Industrial Education Department
East Texas State Teachers College
Commerce, Tex.

Tin-can craft is comparatively well known, but its use as a part of the metal program in a general shop or as a craft in the home workshop has not been appreciated to the full extent. This neglect is due to several reasons, one being that projects produced from sheet tin or tin-can stock are not sufficiently removed from the general appearance of the original tin can. Projects can be made to look exactly like the more expensive copper products by sweat soldering two pieces together to produce sheet stock about the thickness of 18- to 20-gauge metal. After this has been done, the sheets can be treated similarly to heavier art-metal stock with the same satisfactory results.

Art-metal treatment of projects can be further ornamented by the simple and inexpensive means of plating. Copperplating of the project is a very satisfactory means of stimulating interest on the part of the student, his parents, and the homecraftsman, since there is always a place in every home for beautifully finished pieces of copper work.

One must not assume that copperplated tin-can projects present a crude or rough appearance. The photograph displaying the numerous desk accessories in Figure 1 will show the reader the attractiveness of such articles. Projects of this type impress onlookers as being truly lovely copper articles. It is always necessary to explain to them that these appealing projects consist of tin-can stock which has been sweat soldered for thickness, and then copperplated. Visitors and patrons who have seen exhibits of these articles were surprised and gratified to learn that the processes of sweat soldering and electroplating are relatively simple and easily understood by students and craftsmen.

There are several distinct advantages in adding this activity to the activities now carried on in the general shop laboratory of industries, general-metal, art-metal, or sheet-metal shops. First is the inherent possibility which permits the correlating of the industrial-arts program with science. The student usually wants to understand the chemical action which is taking place when copperplating, and in this way he or she is introduced to an elementary practical knowledge of science. Second, this auxiliary activity of plating can play an important role with the student of the electrical division of the general shop. Third, it aids in *selling* the laboratory program to the student and to the public, because the beautiful finish adds greatly

Fig. 1. Articles made of copperplated tin sheets

to the interest; and fourth, this cleverly developed craft adds *spice* to the metal division, especially when interest in metalwork has been difficult to arouse because of limited equipment.

Building up sheet stock to make attractive projects which are then copperplated adds zest and appeal for the home craftsman as well. Little material is necessary and the few tools required to start and develop this unique metal craft are probably already at hand. The following series of projects will enable the student and novice to try his hand in making articles of tin craft.

Building Tin-Plate Stock

The process of soldering two pieces of sheet stock is relatively simple if certain precautions are observed. Of course, as may be expected when developing skill in any new craft, the student or novice will improve various skills as he proceeds with additional projects. Figure 2 illustrates the manner of applying solder to one side of each piece of tin which will be later joined by sweat soldering. The metal must be cleaned with steel wool or with a cleaning solution to remove impurities from the surface so that solder will flow readily to all parts. Solder can be applied as in any sheet-metal work, allowing flux to play its important role.

It is suggested that the solder be applied freely to both pieces. It is also advisable to place the metal sheet on a piece of asbestos, such as asbestos shingle, to prevent the heat from escaping to the metal bench top or scorching the wood bench top. Ordinary paste flux or a liquid prepared zinc-chloride flux is excellent for this purpose. Bar solder of the 50–50 variety had best be used as it is less expensive than wire or core solder. After covering the tin sheets with solder, they are ready to be sweat soldered together to form the heavier gauge metal desired for art metalwork.

Figure 3 shows how the two pieces may be sweat soldered together. The flat iron should be heated on a gas unit or gasoline torch or fire pot to the temperature necessary to melt solder and thus unite the two pieces of metal. If a flat iron is used, as illustrated, the handle is detachable, thereby permitting the iron to be heated without getting the handle too hot.

Lay the pieces of metal on an asbestos sheet so the soldered surfaces face each other. Place the heated iron on one end of the sheets and allow the heat to melt the solder. Move the hot iron slowly so the pieces will sweat together thoroughly. As the iron is moved, the heated portion should be covered immediately with another piece of asbestos which is held in place with a heavy weight to keep the sweated stock together until it cools. See Figure 4.

When the pieces have been soldered together in this manner, a sturdy heavier gauge of metal results which is suitable for the ornamental tin craft work shown in Figure 1.

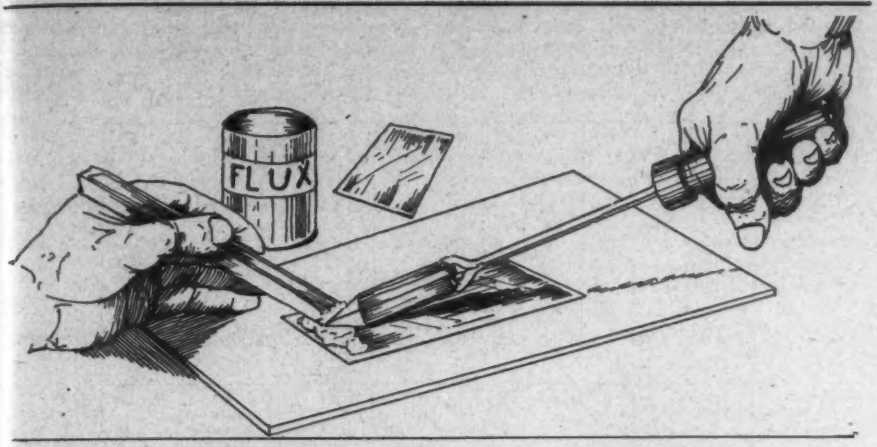

Fig. 2. Applying the solder preparatory to sweating two pieces of tin-can stock together

It is best to clean the stock with steel wool before proceeding with the project construction. Also remove excess solder which may have crept to the surfaces from the edges as it was being sweat soldered. It may be necessary to practice on a few pieces of scrap tin sheets before attempting to work out the desired project. The result of this process will be surprising and satisfying. The metal can be peened, bent, formed, or pierced, as if it were heavy art metal.

Copperplating

The copperplating equipment described and illustrated in Figure 5 makes use of everyday materials which may be found in any hardware store. These items include an earthenware or stone crock of 2- or 4-gallon capacity; the water vat which may be made in the school shop from galvanized sheet metal or may even be a large dishpan; a gas or electric hot plate for heating and maintaining a constant temperature; cathode support which may be a round or square piece of scrap wood; 5 ft. of any available insulated copper wire; two ordinary 1½-volt dry batteries; a thermometer; and a piece of sheet copper.

After securing the necessary materials, the following steps should be observed in order to secure maximum efficiency.

1. *Cleaning.* The importance of cleanliness in plating cannot be stressed too strongly. The article that is to be plated must be cleaned with steel wool and then washed in hot water and soap. Pickling the project in a 10 per cent solution of sulphuric acid is also a good method of cleansing. The project to be plated is known as the *cathode.* The sheet of copper in the bath, known as the anode, must also be washed perfectly clean before each plating job. Make it a rule to start all plating operations by thoroughly washing the hands, the cathode and the anode.

2. *Mixing Plating Solution.* Many formulas are available, but the following one has proved to be efficient and inexpensive. The solution may be made according to the following formula:

Copper sulphate	5	oz.
Sodium cyanide.....	4½	oz.
Carbonate of soda.....	2	oz.
Hyposulphite of soda....	1/64	oz.
Water	1	gal.

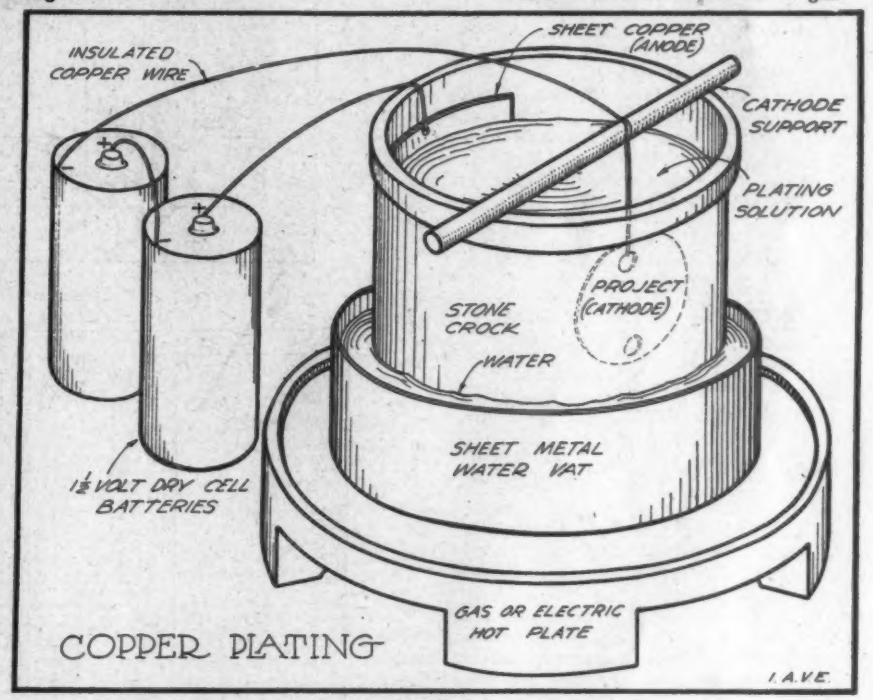

Fig. 5. Copperplating equipment

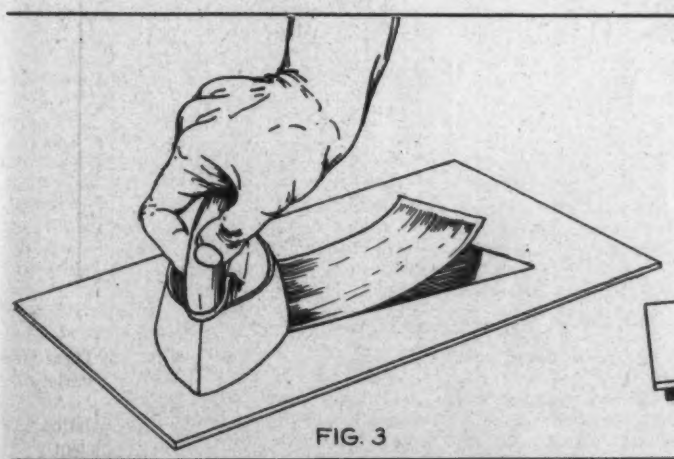

Fig. 3. Starting the sweating operation

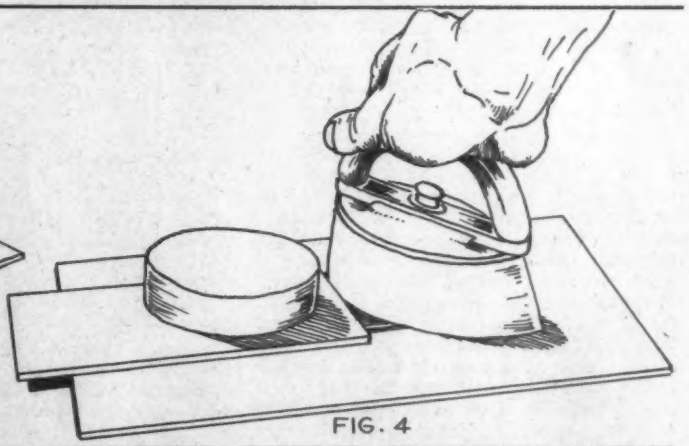

Fig. 4. As the sweating proceeds

Heat the solution to 120 deg. F. by the method illustrated.

3. *Required Voltage.* Copperplating with the enclosed formula requires three volts. Be sure that all connections are properly made.

4. *Assembly.* If a nonmetallic lid cannot be purchased to fit the crock or jar, it is advisable to store the solution in bottles or containers which are not metallic. Before beginning to plate, be sure that all preliminary operations have been completed and checked. Then heat the solution to a temperature of 120 deg. F. The proper temperature may be obtained by checking with a thermometer.

5. *Plating.* Stir the solution occasionally while the plating action is taking place. Do not allow the cathode and the anode to touch. Be sure that the project is entirely immersed in the solution during the plating action. One to two hours are required for plating each project. Although the volume of solution decreases, its strength is not appreciably affected, due to the copper salts remaining and only the gases breaking up and evaporating. Water may be added from time to time to keep the volume regulated. This mixture sometimes lasts for a period of six months without adding salts.

6. *Final Cleansing.* Rinse the plated article in hot water, and allow 20 to 30 min. for a thorough drying, then clean and polish with steel wool until it becomes glossy. Apply one or two coats of clear brushing lacquer immediately to prevent oxidation.

MOLDING PLASTICS IN HIGH SCHOOL

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Now in the U. S. Army

(Continued from page 435 of the December, 1943, issue)

Type of Molding Plastic

While the different plastics resemble each other somewhat in appearance, they are quite different in other respects. This is particularly true of their chemical and molding properties.

Naturally, the greatest difference exists between the thermoplastics and the thermosetting types. Let us again review this difference. The thermoplastics are softened each time they are heated to the softening temperature, but the thermosetting plastics soften only on the initial application of heat and subsequent heatings only serve to cause further hardening of the material to take place. These plastics also require much higher temperatures and pressures for successful molding.

Thermosetting Plastics

The most commonly used thermosetting plastics are the phenolics. These plastics are made from phenol (carbolic acid crystals) and formaldehyde (a common preservative). Sometimes other aldehydes are used as furfuraldehyde (made from oat hulls) instead of formaldehyde. The phenol combines chemically with the formaldehyde and with some care a fairly clear and transparent syrup is obtained. This syrup thickens upon the continued application of heat until the hard plastic is obtained.

Generally the syrup is amber colored or even darker and it can only be dyed or pigmented to any color that is darker in shade than the natural amber color. For this reason brown and black colors are most commonly found in the phenolics, although reds and even whites can be obtained with care.

Another use is to impregnate or soak the syrup into fabrics or papers which are then pressed together to make tough sheets that resemble the regular plastic sheets. Sometimes the syrup is poured into special molds where it is hardened and castings secured. These cast forms are then used to fabricate a variety of projects.

Type B phenolics are the solid plastics, but they have not been heated sufficiently to

Type of Thermoplastic	Compression molding Temperatures (deg.F)	Compression molding Pressure (lbs. per 1 sq. in.)	Specific gravity (Variations depend on fillers)	Mold shrinkage (positive molds)	Softening temperatures (Deg. F.)	Insoluble in and unattacked by	Solvents
Cellulose Acetate	250 to 350	1500 to 5000	1.26 to 1.40	.002 to .009 in. per in.	145 to 260	Oils, gasoline, benzine, carbon tetra chloride	Acetone
Ethyl Cellulose	230 to 240	1500 to 5000	1.14		230	Alkalis, dilute acids	Alcohol Acetone
Methacrylate Polymer	300 to 375	2000 to 5000	1.19	.003 to .005 in. per in.	180	Water, oil, lyes, acid, glycerine	Acetone Benzine
Polystyrene	240 to 350	1000 to 5000	1.05	.002 to .0025 in. per in.	220 to 240	Strong lye, strong acid oils, waxes, alcohol, water	Benzine Gasoline
Polyvinyl	240 to 300	1200 to 2000	1.3	.0000 to .001 in. per in.	140 to 160	Acids, alkalis water	Alcohol Gasoline Acetone Ether
Shellac	200 to 225	500 to 2000			200		Alcohol

Types of Thermoplastics

PLASTICS COMPARATOR — Plastic Material	Toughness (Impact Strength)	Flexural Strength	Tensile Strength	Color Stability	Cold Flow	Water Resistance	Acid Resistance	Caustic Resistance	Solvent Resistance	Dimensional Change on Aging	Heat Resistance (Cont. Heat)	Flammability	Heat Insulation	Specific Gravity	Hardness	Loss Factor	Resistivity	Dielectric Strength	Moldability Around Inserts
Phenolic: General Purpose	10	3	3	7	1	6	3	4	1	4	2	3	2	8	5	10	7	4	2
Phenolic: Low-Loss	11	3	7	7	1	3	4	4	1	2	3	1	7	12	3	4	3	3	2
Phenolic: Heat-Resistant	9	4	8	7	1	3	4	4	1	1	1	1	7	13	2		8	8	2
Phenolic: Acid and Alkali-Resistant	10	6	8	7	1	4	2	3	1	5	3	2	2	5	4			7	3
Phenolic: Shock-Resistant	2	1	5	7	1	7	4	5	1	6	3	4	3	10	5		9	8	1
Phenolic: Transparent	7	1	3	7	1	4	3	3	1	5	3	2	2	6	4	7	5	6	3
Urea	8	1	1	1	2	9	4	4	1	7	7	5	5	11	1	9	4	2	4
Polystyrene	7	2	7	4	4	1	1	1	3	3	6	6	1	1	6	1	1	1	6
Cellulose-Acetate	4	6	9	3	8	11	4	6	3	9	5	6	4	7	9	8	6	5	5
Aceto-Butyrate	1	5	10	3	6	8	4	4	3	8	4	6	6	4	8	3			5
Ethyl-Cellulose	3	2	6	6	7	10	4	2	3	8	5	6	4	2	8	2	2	1	5
Methyl-Methacrylate	6	1	4	2	5	5	2	2	3	8	9	6	2	3	7	5		2	6
Vinyl (No Filler)	5	1	2	5	3	2	1	1	2	3	8	6	2	9	7	6	3	1	5

On this comparator No. 1 is high, while 13 is low

Phenolic plastics are classed as types A, B, or C. Type A is the thick syrupy form. In this form it can be mixed with certain oils and pigments to make paints or varnishes. It can also be used as a cement and adhesive.

secure the heat resistant form. Short or limited applications of heat will soften these plastics so that they can be formed and molded to desirable shapes. It is from this type that molding powders are made by grinding up the plastic to powder form.

Phenolics are made in a very large variety of forms and types, ranging from rather brittle types to very tough, shock-resisting types. Largely, these variations are secured by different fillers that are mixed in with the plastic during the A stage. Fibrous fillers improve the shock resisting qualities. Asbestos fillers improve the heat resisting and insulating qualities.

Phenolics find large usage as electrical parts, housings for small machines and motors, door knobs, drawer pulls, handles for knives and utensils.

Another group of thermosetting plastics are those commonly referred to as the ureas. These plastics are made by chemically combining urea (found in the urine of animals and made artificially) with formaldehyde or furfuraldehyde. These plastics possess a beautiful finish that seems to improve with use. This plastic can be made in water-clear color and has been referred to as "organic glass." Due to this clarity it has a wide range of color possibilities.

Like the phenolics the ureas go through the A, B, and C stages in their manufacture. They are used in the same places as are the phenolics, but their better color possibilities give them a larger possible usage.

Ureas are also difficult to mold as they require special stainless molding equipment. They are commonly used to make light switches, wall plates, dishes, handles, knobs and pulls, boxes and special cases, and housings for small machines. Radio cases, memopad housings, and lamp shades are made from urea plastics.

Phenolic plastics require the use of stainless steel dies for molding. If such dies are not available, then ordinary steel dies may be used if they are plated with chromium or nickel. This is necessary as the formaldehyde fumes that escape during the molding processes cause a brown stain to appear on the steel molds. Some of this stain penetrates the surface of the plastic as a brown stain.

The C stage of the plastic is secured by continued heating from the A stage and through the B stage. Further heat will not soften C stage phenolics and it cannot be formed or molded to any shape.

Casein plastics compose another fairly common group of thermosetting plastics. These plastics are made by extracting the casein (the white curds) from cow's milk. This casein is then hardened by treating it with formaldehyde and pressing it into sheets or rods. These sheets and rods are further cured by soaking in formaldehyde and then drying slowly. These sheets and rods are then formed into useful articles, the most common of which are buttons, buckles, brooches, and similar articles.

Casein plastics are often referred to as protein plastics. The casein of the milk is a protein compound as is urea. Such protein compounds are hardened by formaldehyde and may be used to make plastics. The wool of sheep and the fur and hair of other animals are examples of a protein plastic thread or fiber that is made by nature.

Thermoplastics

The thermoplastics are best suited to school molding because of their low softening temperatures and low molding pressures. They may also be remolded many times. The most common thermoplastics will be described.

Nitrate cellulose or celluloid is a thermoplastic that has a high burning rate and hence is too dangerous to mold in the school shops. It contains only a little less nitrogen in its composition than does guncotton and in powder form is quite explosive. It can be distinguished by its smell and burning rate.

Cellulose acetate is a tough, shock resisting plastic. It is made by treating cellulose (the material of which cotton fibers or the walls of plant cells are made) with acetic acid (the sour taste of vinegar is caused by acetic acid).

Cellulose acetate has a beautiful surface and a wide color range. It is resistant to sunlight, and yellows only slightly from long exposure to the sun. It can be made in water-clear color. It burns slowly and its toughness makes it well suited for handles and knobs. Like wood it is warm to the touch. It molds well and is well adapted to school use.

The greatest defect of this plastic is its high water absorption, with resulting increase in weight, distortion of size and shape and loss of electrical insulating qualities.

It has good tooling and machining qualities and finishes beautifully. It takes a fine and lustrous finish directly from the polished molding dies.

Ethyl cellulose is a flexible and tough plastic, even when cold. It is made of the ether of cellulose and ethyl alcohol. The ether is secured by the reaction of ethyl alcohol upon alkali cellulose.

It is fairly resistant to water when cellulose fillers (cotton linters or fibers) are not used as fillers. It has a rather short range of molding temperature. If temperatures below this range are used, then the knitting of the individual grains of molding powder is imperfect. If temperatures above this range are used then heat marks and bubbles begin to appear.

It has a wide color range from clear to opaque. It is compatible with some oils and waxes.

Methyl methacrylate is an acrylic acid derivative. It is characterized by its remarkable clarity and transparency. It reflects light internally or *pipes* it, even around curves. It is perfectly stable to light and does not yellow. It absorbs negligible amounts of water and is fairly resistant to 30 per cent concentrations of alkalis and to 60 per cent concentrations of acids. It burns slowly and has good electrical qualities.

It can be dissolved in solvents and used as lacquer. Baking improves the adhesive qualities of such lacquers, particularly to metals.

It is excellent for draw molding from sheets and it can be compression molded. It has excellent machining and tooling qualities.

The methacrylates find wide usage, ranging from the enclosures for airplane cockpits to tiny costume jewels. It is widely used as artistic ornaments for household decoration and for a variety of household utensils — salad forks, spoons, icetongs, bowls and dishes, table lamps, and even for furniture. In the field of lighting and sign displays it is widely used because of its clarity, internal reflection, and lightness of weight.

Polystyrene is an excellent molding plastic since it flows so well when heated and subjected to pressure. It is made by polymerizing acetylene (a gas commonly used in welding). Polymerization is accomplished by heat, pressure, and light.

It has a low burning rate and is an extremely good electrical insulator — the equal of mica or fused quartz. It has a wide color range, but darkens slightly on exposure to sunlight. The clear colors yellow when exposed to light. Strong acids discolor it slightly. Strong alkalis, alcohols, or oils have no effect. It has been fed to persons and skin exposures made without any effect whatsoever.

It is not flexible, but holds its shape exactly until breakage occurs. In other words, it has good dimensional stability. It is about as strong as the other thermoplastics and has good machining qualities. The heat from friction incurred by rapid machining will soften the plastic unless some heat transfer liquids are used while cutting at high speeds. It has a very glossy finish.

In molding, it is best not to cool it too rapidly, because, due to its low heat conductivity, the surface cools and hardens faster than does the center. When the center finally cools, it shrinks considerably and causes internal strains to be set up or shrinkage cavities to occur. If polystyrene is stretched while cooling, the strains become permanently frozen into the surface.

Molding powders usually contain some monomer or other volatile material. Hence, it must be formed above the boiling point of these which is 302 deg. F.

Polystyrene finds wide usage. In the high frequency electrical field it is unsurpassed as an insulator. Due to its chemical inertness, it is useful as containers for alcohols, water, acids, fruits, and other foods.

The *polyvinyl* plastics are a mixture of monomeric vinyl acetate and monomeric vinyl chloride. This mixture of monomers are polymerized together and the good points of each are given to the final plastic. By varying the proportions of these monomers, any type of vinyl plastic from a tough, rubber, flexible plastic, to a hard, brittle material may be secured.

Vinyl resins are water resistant, chemically inert, and much used in making finishing materials. It is also ideal as a plastic since it has little or no shrinkage. Its use in large molds is desirable since it will not crack or warp after removal from the mold.

It darkens somewhat upon continued exposure to light, but can be dyed or pigmented to any color. Light is the principal medium used to secure polymerization of the monomers.

Fillers can be used to produce opaque colors as the pure plastic is transparent. However, fillers may impair its shrinkage and other qualities if used excessively.

This plastic can be attached to wood or metal by hot pressing as the pressures required to make a successful bond will not crush the wood or even celotex.

It has good electrical qualities and a low burning rate. It is used for airplane dope and glue. Long life phonograph records, dentures, coatings on architectural tiling, desk articles, cosmetic containers, and table ware illustrate the wide usage of this plastic.

Shellac is a thermoplastic that is not made by man, but occurs on certain trees of the Orient. The tree deposits the resin on its limbs and twigs as the result of insect infestations.

Shellac was formerly widely used to make electrical insulators and a few table articles, but has been replaced by the better synthetic plastics. It does have some use in the school shop, however, because of its ready availability. Old phonograph records can be secured very cheaply and these can be ground to make

molding powder with which the student can experiment. It has a very low molding temperature and pressure.

General Consideration

In molding plastics, do not attempt to mix the different kinds of powders. In general, few of the plastics are truly compatible with each other. Such mixtures, then, will not bond together perfectly. It is all right, however, to mix different colors of the same type or kind of plastic in order to secure beautiful mottled effects.

CHECKING TOOLS BY COLORS

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A. & M. College of Texas
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There are a great many different ways of checking tools in the general shop. Some instructors still prefer a toolroom, where one boy stands at the window and issues all of the needed tools. By this method much time is lost, tools are piled on one another at the window, and the student often forgets that he is in any way responsible for the care of the tools. A few instructors still use the panel or drawer method where a number of tools are attached to a board or placed in a drawer and the complete set is issued to the student. By this method, the student frequently receives more tools than are necessary. Not only are these unnecessary tools in his way as he works, but this calls for a duplication which is the chief fault of most tool distributing methods in the school shop. There are many other tool checking methods in use now.

The best method, of course, is the one which makes the tools most accessible to the students.

Many superintendents and school boards have complained on account of the high cost of shop equipment per capita. In too many instances they have been justified in their complaint. Many instructors have wasted money in purchasing duplicate tools that they did not need. In one case — an extreme example — a teacher purchased 20 braces and as many sets of bits for a class of 20 boys. Doubtless only two of these braces were in use at any one time during the class period.

The correct number of any kind of tool would be that number which would prevent one student having to wait on another for a tool that is in use. Certainly, if a class is not going to use but 12 hammers, there will be no excuse for the purchase of the thirteenth one.

If the tools in the shop are to be used to the best advantage, the problem of caring for and making them accessible to the students must be faced. If there is only one tool of a certain kind in the shop, great care should be taken that this tool is not misplaced or lost. The temporary misplacing of a tool may cause some student who needs it great inconvenience or loss of time.

We are in a new era of education. We must teach the shop student more than how to sharpen a chisel, saw a straight line, or forge out a piece of metal. We must teach him to be an honest, upright citizen. Much of this may be done right in the shop by putting more responsibility on the boy. He should be taught from the beginning that it is his workshop and that he must remember that his parents are helping to pay for the tools and equipment with which he works. In most cases, the boy will take a great deal of pride in the shop tools if he knows that he is responsible for them.

Fig. 1. Tool cabinets with tools painted in four different colors. Doors removed

General tool cabinets are, no doubt, the best means of making the tools available to a class of boys. Here the students secure from the cabinet the tools that they need and carry them to the workbench. When they are through, they return the tools to the cabinet.

This brings up the problem of getting the hammer or chisel back in the place where it belongs. This is very easily taken care of by the color scheme as shown in Figures 1 and 2. In the first cabinet on the left in Figure 1, all the tools are identified by painting the handles or a part of the tool red. The shanks of the auger bits are all painted red. The tools in the other cabinets are given colors of green, blue, and orange. In case a student is using an orange hammer or an orange saw, he will have no difficulty in putting them back in their proper places.

Tools may be scattered over the shop, yet, if they are properly marked, they are easily and quickly replaced in the cabinets.

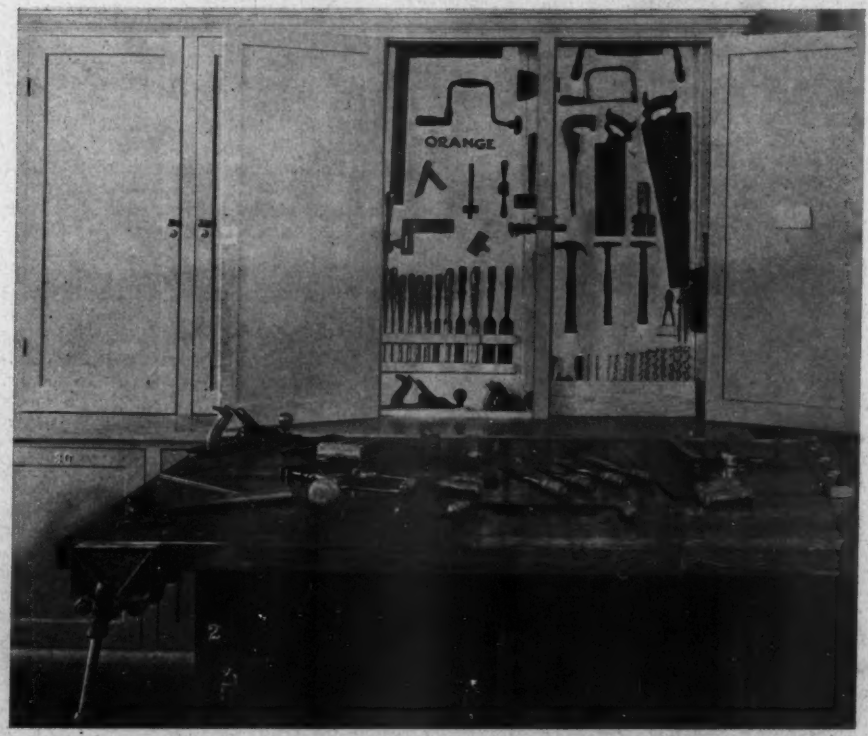


Fig. 2. A tool cabinet with tools painted orange. The black silhouettes indicate the tools are removed

Each tool in the cabinet should be properly silhouetted. Then, at the close of the class period, if there is a black silhouette showing, it indicates that a tool is missing.

The color that marks the tools in the cabinet is painted just above the lock. This is a space about two inches square, which, in case the tool is taken out of the shop, enables the tool to be identified and replaced in the cabinet in which it belongs.

The problem of taking care of the keys belonging to the various cabinets is one that has bothered many instructors. Keys are often issued to students. If they are lost, duplicates have to be made, and as a result, the lost keys may be responsible for tools being stolen.

The keys should be kept in the shop. They should be put on ¼ by 2 by 6-in. boards and placed in a separate locker. The key is fastened to the board with a stove bolt with the end of the bolt riveted over the nut. See Figure 3. The key boards should be painted some bright color and the number of the locker should be put on the board. When placing the keys in the cabinets, they should be silhouetted. Keys to the workbenches may also be placed in the key cabinet.

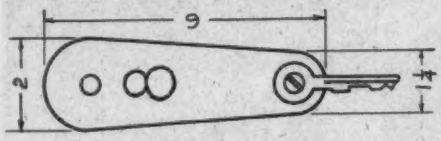


Fig. 3. Keyboard and key

When the class enters the shop, the instructor unlocks the key cabinet. The students then unlock their tool cabinets and workbenches and return their keys. Snap locks are always best for a shop and in case this type of lock is in use, as soon as the students have returned their keys to the instructor, the key cabinet should be locked.

At the close of the class period, the instructor may quickly check the tools before the cabinet doors are closed. This checking may also be done by a student known as the *tool checker*.

A large general tool cabinet may be used or a series of small cabinets. The small cabinet has some advantages over the large one. So far as possible, each small cabinet should be equipped with the most important tools, such as saws, hammers, and squares. Each cabinet may be assigned to three or four students. The student is directly responsible for his cabinet. By choosing the cabinet nearest his bench, time is saved in going back and forth after tools.

There may not be enough tools to fully equip each locker. In this case, some cabinets may be better equipped than others, as shown in the orange cabinet in Figure 2. In case only one or two students are working in the shop at odd times, then they will use the best equipped locker. It will not be necessary then to open additional lockers.

Small cabinets may be placed in other parts of the shop. The blacksmithing tools should be kept in a cabinet near the forge. Likewise, it will be found convenient to place a cabinet near the sheet-metal bench.

Each cabinet should be numbered as this will aid in assigning students to locks, locating locks for keys that are numbered, and in taking inventory.

The cabinets in which the tools hang are constructed in such a way that the backs slant at an angle of about 15 deg. See Figure 4. This allows each tool to lie flat against the panel, and is much better than having them hang on a vertical wall. Where the backs are vertical tools occasionally fall off or fail to make contact with the panel.

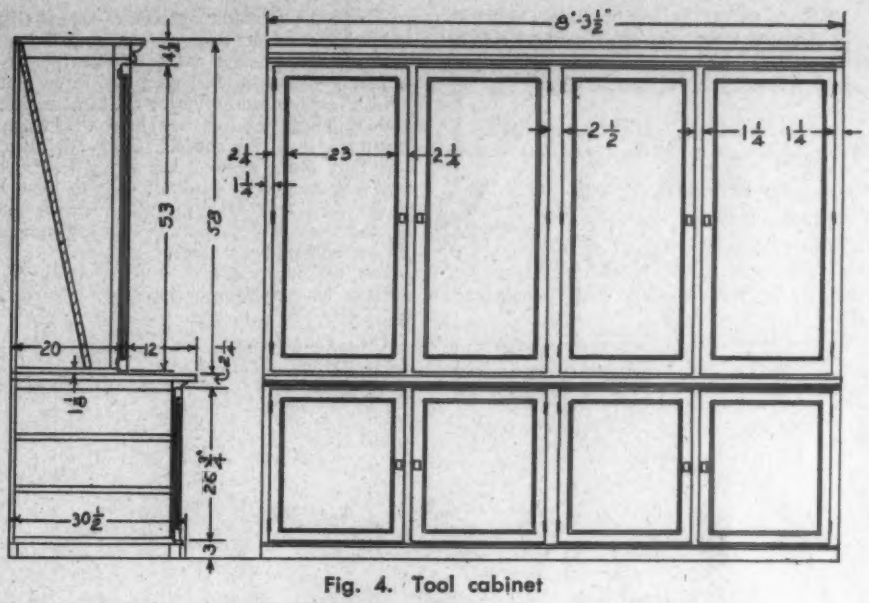


Fig. 4. Tool cabinet

The storage space below may be used for storing tools that need repair; screws, bolts, nails; or unfinished projects. These cabinets are numbered and locked in the same way as the upper tool compartments.

INTERNATIONAL DRAWING EXCHANGE

WALTER G. HJERTSTEDT

Director
Chicago, Ill.

Postwar Objectives

1. To exchange drawings and other educational material and to accept and assimilate ideas from all over the world, especially from Central and South America.
2. To establish a permanent educational exhibit to include the work of architectural, engineering, and art students in foreign countries.
3. To cooperate educationally with all occupied and Hitler dominated countries and to win the peace when the war is on.
4. To give for the sake of giving and to give those, who are interested in architecture, an accurate knowledge of the architecture of other lands.
5. Ethnologically, to study the racial differences in reference to art.
6. To cooperate in the development of an intellectual program to re-educate Nazi indoctrinated people.
7. To achieve unity between the nations of the world which may lay the foundation for a universal era of peace and good will between the nations of the earth.
8. To exert a direct influence upon the established policy of cooperation between the United States and other countries.
9. To bring about a world-wide exchange of ideas for the advancement of education, and to obtain new ideas in art, architecture and engineering, and mechanical designing from foreign countries.
10. To learn of the accomplishments and difficulties of students in other countries, and to inject a spirit of romanticism into the daily routine of schoolwork, and provide an educational diversion for the students.

Fig. 2. A handy all wood wheelbarrow

"Science and art belong to the whole world, and before them vanish the barriers of nationality."

ALL WOOD WHEELBARROW

J. I. SOWERS
Director of Industrial Arts
Miami, Fla.

The wheelbarrow shown in Figures 1, 2, and 3 is very handy for home use, and it may be easily made in the school shop. Since we designed this at the opening of school this year, many students have chosen to make one. It has proved popular not only with the students in our shops, but with the fathers at home. Since we can no longer get high cabinet grade lumber, we use any kind of lumber procurable for this project. Many of them have been made of second-grade cypress, but they may as well be made of culls of lumber of any kind, and since the wheelbarrows are painted they look as well as if a high grade of lumber had been used.

The wheel is made of 4 parts as shown, and can be turned or band-sawed. The parts are then glued and screwed together. A waterproof glue is necessary on this wheel. All other parts of the job are put together with nails, screws, and bolts, as shown.

It will be noted that but six essential parts are used in the framework of this wheelbarrow, making construction very simple and strong. No machine tools are necessary except for the wheel, making it an ideal job for practice in hand tool construction. Such jobs are unusual within the limits of a school shop. We have seldom had a job in which students evinced greater interest. The drawing is simple

(Continued on page 167)

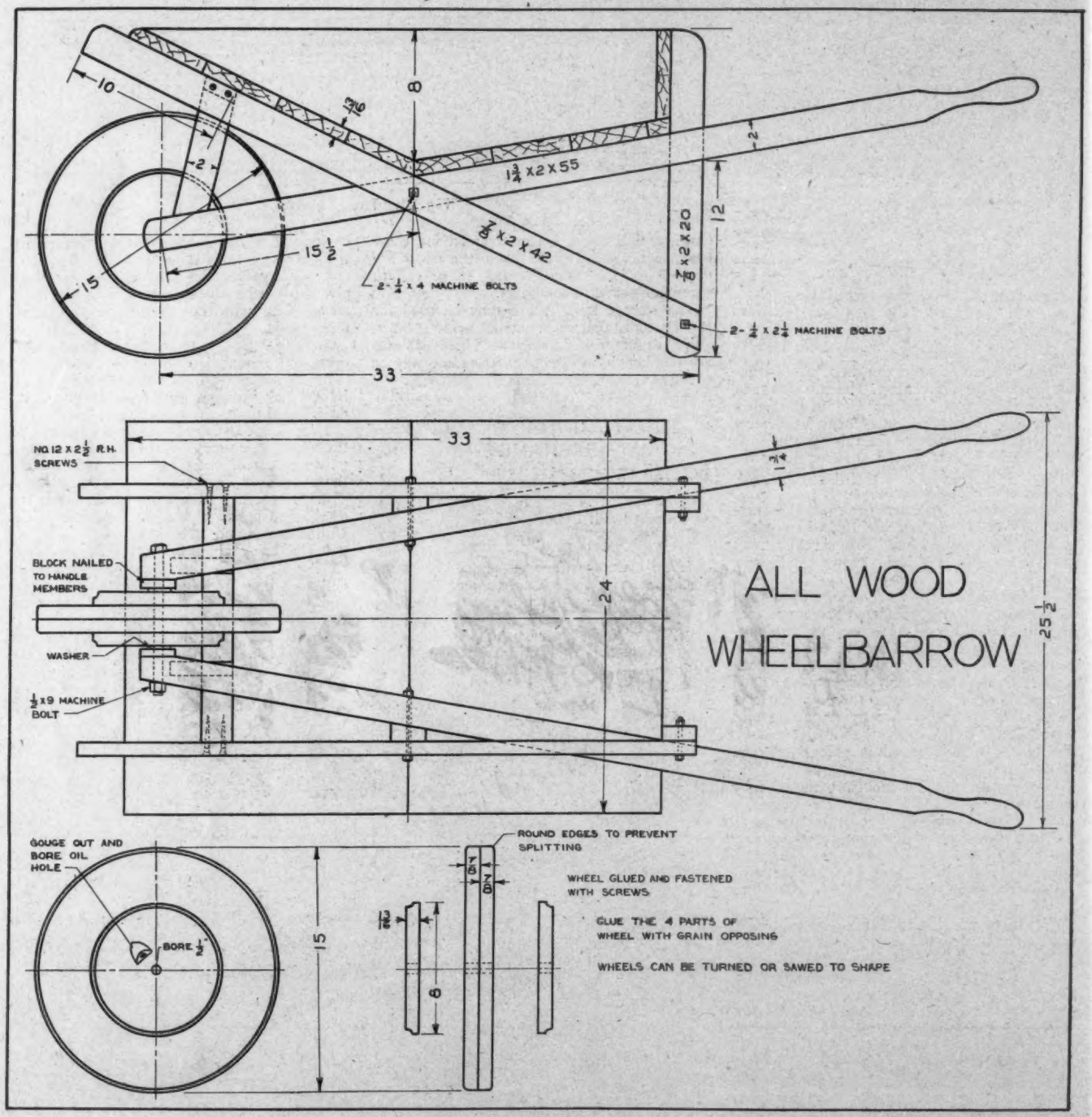


Fig. 1. An all wood wheelbarrow

PLATE 19 APPLICATION ANIMALS

"A LINE OF BEAUTY MUST ALSO BE A LINE OF SERVICE"
• RUSKIN •

HANDLE

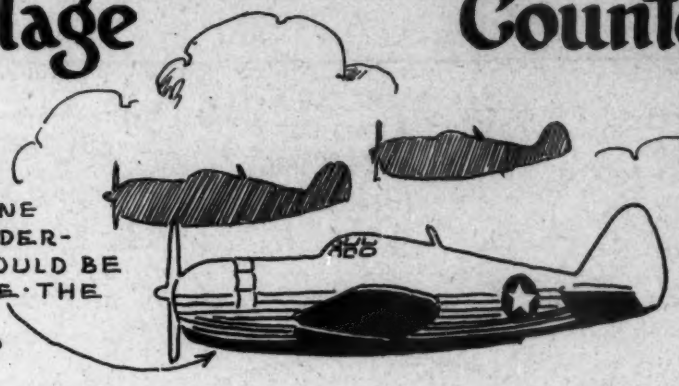
NUT DISH

SHADOW LAMP

DESIGN IS THE DELIBERATE ORDERING OR PLANNING OF SPACE, MATTER, OR ACTIVITY FOR A GIVEN PURPOSE • THE DIVISIONS OF DESIGN SHOWN ABOVE ARE STRUCTURAL, ENRICHMENT OF CONTOUR AND ENRICHMENT OF SURFACE

Plate 19. Creative design course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

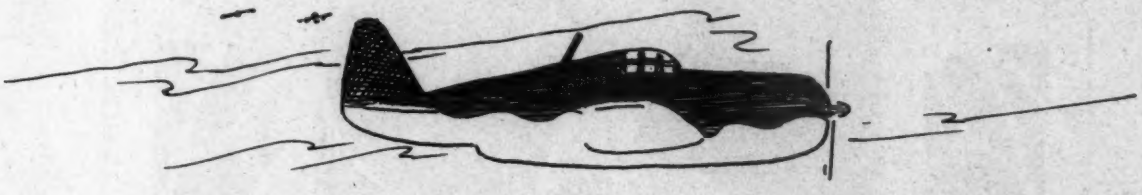
Camouflage Countershading



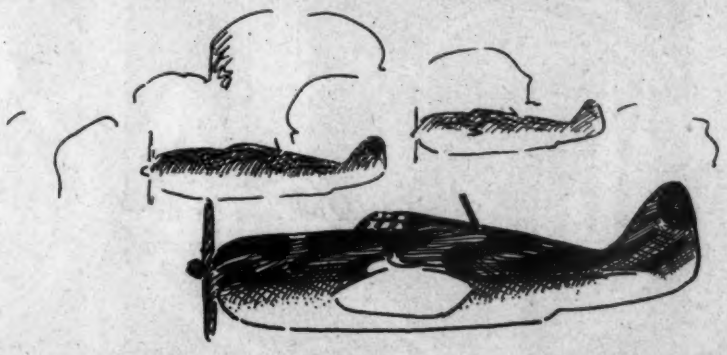
THE ALL LIGHT PLANE WOULD HAVE AN UNDER-SHADOW THAT SHOULD BE PAINTED FLAT WHITE · THE STRONG SHADOW MIGHT BE SILVERED

THE TOPSIDE SHOULD BE PAINTED TO RE— SEMBLE TERRAIN THAT THE SHIP WILL FLY OVER · THE SIDE VIEW SHOULD DISRUPT.

COUNTERSHADOW ON AIRCRAFT IS SIMILAR TO SHADOW ELIMINATION AS FOUND IN NATURE



PLANES ARE RARELY VIEWED FROM THE SIDE EXCEPT BY AN ENEMY PLANE · EFFORT IS LARGELY DIRECTED TO THE TOPSIDE FOR TERRAIN PATTERN AND COLOR RESEMBLANCE · A WAVY LINE IS GENERALLY USED.



ABOVE IS AN ATTEMPT TO BLEND THE SHADOW AS NATURE BLENDS · MECHANICAL REGULARITY OR RHYTHMIC REGULARITY SERVES BUT TO ATTRACT ATTENTION · PATTERN FOR A SPECIAL TERRAIN IS NOT ALWAYS PRACTICAL · IT LIMITS FLIGHT, IS EXPENSIVE, CREATES ADDED FRICTION AND ADDS WEIGHT · ONE LIGHTLY SPRAYED COAT ON A SMALL BOMBER ADDS AS MUCH AS THIRTY SEVEN POUNDS · GOOD, MODERN CAMOUFLAGE TENDS TO LEAD AWAY FROM DAZZLE PATTERN.

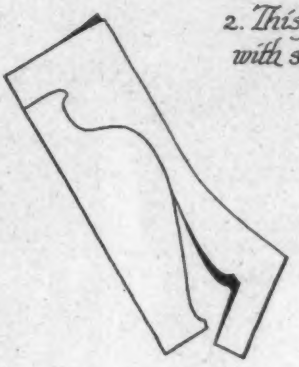
Plate 13. Camouflage course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

HOW ARE TEMPLATES MADE FOR POTTERY?

In contrast to their use on wood and metal, sharp arrises are not made on pottery. Not only would use quickly chip them, but surface tensions in the liquified glazes, during firing, make it virtually impossible to produce a sharp edge. Hence the designer plans flowing lines that move smoothly from one curve to another.

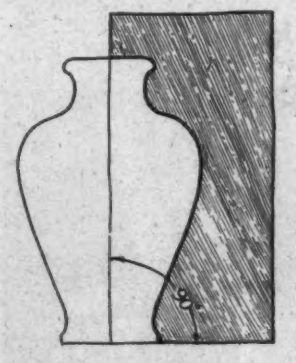
The inexperienced potter will do well to plan forms on paper before starting work on the clay, first studying all fixed requirements of the problem.

1. *After "thumb-nail" sketches have been made to study the problem, a full-size drawing is made (with half diameters) on folded paper.*

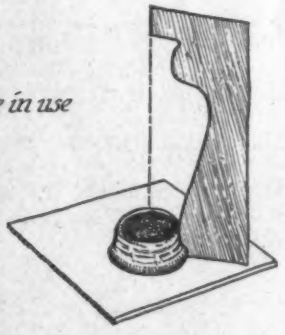


2. *This folded pattern is cut out with scissors.*

3. *The pattern is opened, examined, and improved.*



4. *The pattern is laid on pressboard or cardboard and its outline is traced. The inside of the pressboard is cut away with a sharp knife forming a template of the remainder.*



Template in use

Plate 34. Design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

WHAT DESIGN VARIABLES ARE THERE IN LEATHER?

Morocco-bound Book from Swedish Modern

1. A large number of varieties are available to the craftsman and to machine processes. Each of these varieties has characteristics making it especially suitable for specific uses.

2. Leather is easily cut and assembled into desired forms.

3. It has long been a mainstay for meeting many human needs, and continually their number and range increase.

4. Leather is readily decorated by a number of processes, most of which leave a permanent effect.

Carved and Modeled Leather Spanish Chair

5. Color, texture, finish, thickness, flexibility, modeling capacity, cost, and availability must be considered.

6. Designs should take into account the durability of leather. If the vagaries of style changes are ignored, designs should be made for lasting service.

Bag by Konrad Pfennig from Deutsch Werkkunst der Gegenwart

Plate 35. Continuation of design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

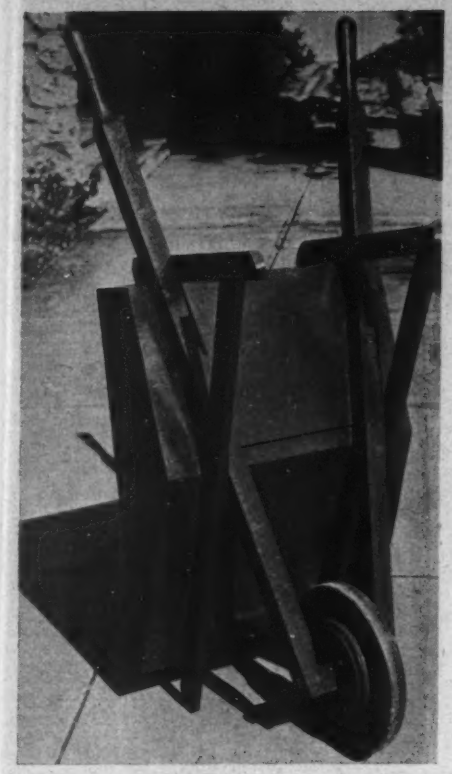


Fig. 3. Occupies little space when standing upright

(Continued from page 162)

and understandable, involving work easily within the comprehension of the ordinary shop student. No special instruction is necessary, other than that contained in the drawing itself.

POLICEMAN'S MACE

C. F. ZAENGLEIN
High School
Circleville, Ohio

Shop instructors often welcome projects which have some connection with war plants, school projects, civilian defense equipment, and the like.

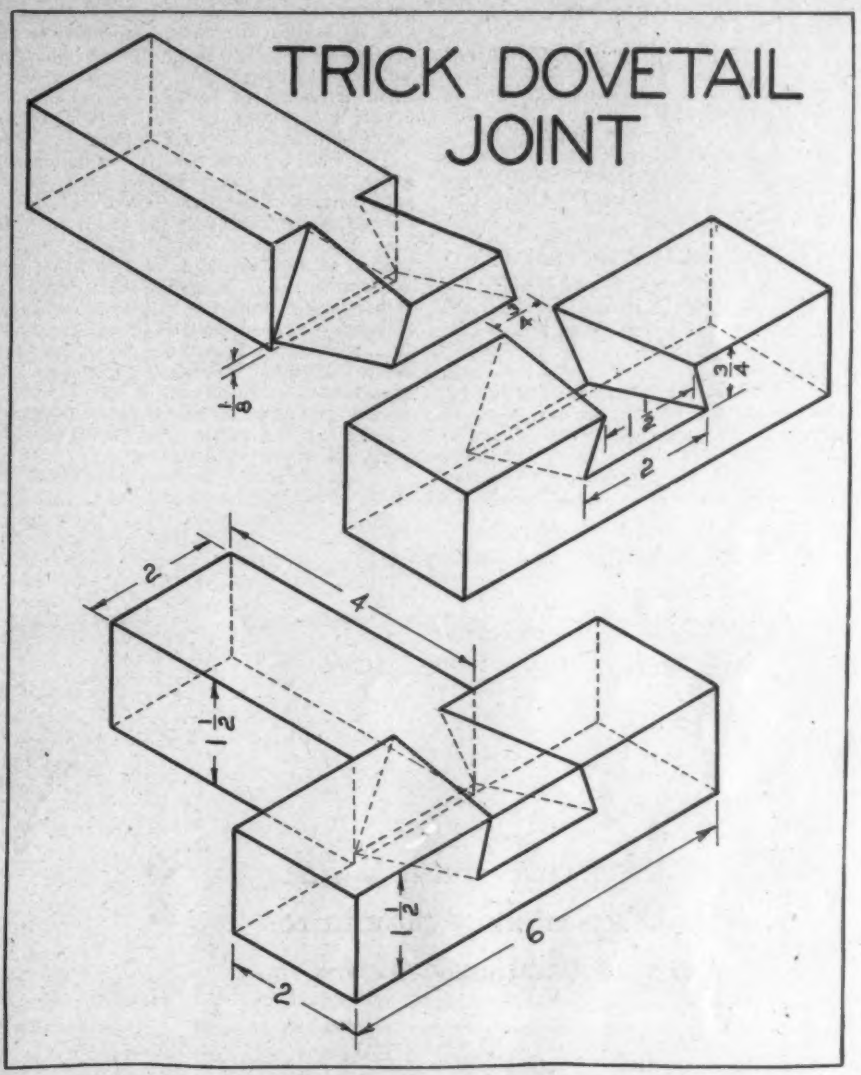
Several months ago our turning class completed a civilian defense project, namely, fifty policemen's maces.

Hard maple wood was used for this project, although other hardwoods such as hickory, ash, or walnut are suitable.

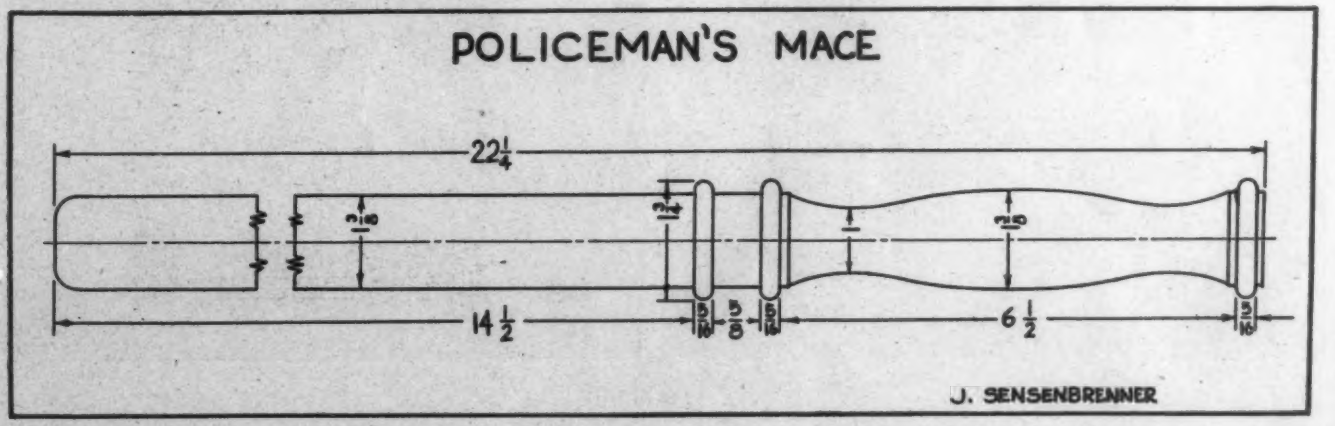
The space between the two beads above the handle provides for a leather strap if it is desired.

After the final sanding with No. 3/0 sandpaper, a natural oil finish was applied.

". . . Every industrial-arts teacher should be ready to state the objectives of his school, of the industrial-arts department within it, and of the particular subject for which he is responsible." — *Homer J. Smith.*



Trick dovetail joint submitted by Harold S. Beal, East Rochester, N. Y.



ASH TRAY

JOSEPH J. LUKOWITZ
Milwaukee, Wis.

Among the many articles which the American Red Cross has asked the school shops to produce are ash trays for the men in our armed forces whether in camps or in base hospitals. The ash tray shown at *A* in Figure 1 meets the requirements as suggested by the American Red Cross.

The making of this ash tray, while a fine patriotic activity, is also an excellent means of teaching some basic principles of working with metal and certain common tools. Skill with these tools should be acquired by all boys. The shallow ash trays commonly made in school shops are not those desired by the Red Cross. They are asking for a deep tray such as that illustrated.

Construction Marking the Can

A very convenient method of marking the can is to use a simple jig such as illustrated at *B* in Figure 1. At *C* is shown how the jig is used. The point of the nail which does the marking should protrude through the board three eighths of an inch. When using the jig, allow the top and bottom rim of the can to rest against the backboard of the jig, and at the same time have the can contact the point of the nail. With this three-point contact against the board and nail by merely rotating the can, a very accurate line will be scribed around the can. The use of this jig will also assure uniformity in the depth of the ash trays.

Cutting the Can

D, *E*, and *F* illustrate the cutting of the can. *D* and *E* are very essential steps preparatory to the actual cutting on the scribed line. By holding the can and tin snips exactly as shown in these three steps no difficulty will be experienced in this operation. Very slight irregularities in the cutting can be evened up as shown at *G*. Very uneven cutting can sometimes be corrected by filing.

The 4-in. diameter base is the bottom of a 4-in. diameter can which has been cut off with the type of can opener which cuts on the outside of the can under the rolled edge. If such a can opener is not available, cut the bottom off with tin snips. Proceed to do this as illustrated at *D*, *E*, and *F*. When beginning step *F*, cut toward the bottom at an angle and then cut as close to the bottom as possible. By following this method of cutting the bottom off with tin snips, a slight edge less than 1/16 in. in height will be left. This edge may be filed off or hammered lightly to flatten it. The cut part of the base should face up when the tray is finished.

Soldering

Before attempting to do any soldering be sure to polish all points of contact with steel wool. It is well to use soldering paste as a flux because the snippets of solder will stick in the paste and remain in position while the tray is being adjusted before applying heat to the joint. Use very small pieces of solder. Ordinary wire solder can be hammered flat and then be cut into very thin small pieces. Small pieces of solder require less heat to melt and flow more readily.

It is very easy for boys to do a perfect job of soldering by using a lighted candle as a source of heat as shown at *J*. After two opposite sides are soldered or tacked, revolve the tray and continue the soldering. Hold the flame directly under the joint and the solder will flow around following the heat. Instead of holding the tray on the vise while soldering it may be held on two bricks standing on end. Any other suitable weight may, of course, be used instead of the brick shown at *J*.

Cigarette Holders

The cigarette holders should be cut as shown at *K*. Rub all of the edges with emery cloth to remove the sharpness of the cut edges and then shape them over a round metal or wood rod. At *L* is shown a simple

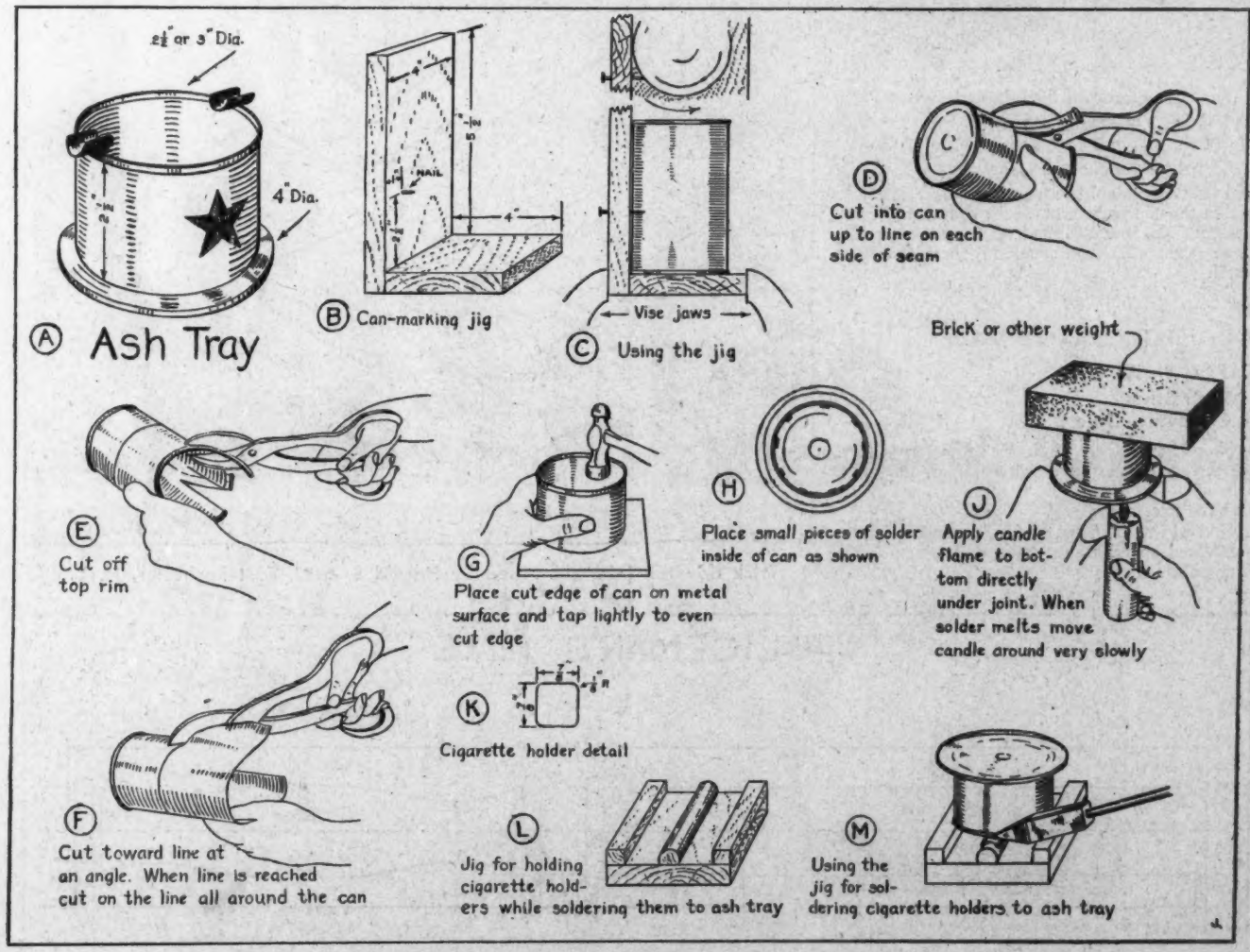

2½" or 3" Dia.
4" Dia.
Ⓐ Ash Tray
Ⓑ Can-marking jig
Vise jaws
Ⓒ Using the jig
Ⓓ Cut into can up to line on each side of seam
Ⓔ Cut off top rim
Ⓕ Cut toward line at an angle. When line is reached cut on the line all around the can
Ⓖ Place cut edge of can on metal surface and tap lightly to even cut edge
Ⓗ Place small pieces of solder inside of can as shown
Ⓙ Brick or other weight
Apply candle flame to bottom directly under joint. When solder melts move candle around very slowly
Ⓚ Cigarette holder detail
Ⓛ Jig for holding cigarette holders while soldering them to ash tray
Ⓜ Using the jig for soldering cigarette holders to ash tray

Fig. 1. Ash tray

jig which will facilitate the soldering of the holders by keeping them in position. The jig is shown in use at *M*. Boys should be instructed to hold the soldering iron with one face of the tip against the cigarette holder and one face against the tray so that both pieces are properly heated. Caution them also not to remove the iron as soon as the solder flows, but to keep it in position so that the solder will form a fillet between the tray and cigarette holder. The formation of this all-important fillet will be insured if, when the solder flows on the cigarette holder, the soldering iron is raised very slightly from the holder and held in contact with the tray. Solder flows toward heat and this maneuver will draw up a very large fillet.

The Finish

After all soldering is finished, wash the ash tray in warm water, wipe, and then sandpaper with rather coarse sandpaper. This sanding operation will provide a tooth or hold for the enamel. Bright colors are suggested. For contrast, enamel the inside of the cigarette holders black. There are, of course, many ways of decorating such a project, but simplicity is appropriate here. Stickers of small American flags, shields, stars, and gummed pictures of soldiers, sailors, and marines may be purchased and used for decorations on these trays.

That these ash trays answer the purpose is evidenced by the following letter:

January 13, 1944

Industrial Arts Department
Brown Street School
2029 N. 20th Street
Milwaukee 5, Wisconsin

Dear Boys:

The ash trays you made are just right — so well made and so nice and large. We thank you very much for all the work you put into the making of them.

They tell us at Headquarters that the camps never seem to get enough ash trays — and as you know, our quota for them from Milwaukee is very large. You made so many you helped considerably in filling the number. We are most appreciative.

Many thanks to all of you, and to the teacher, too!

Sincerely,

(Miss) Margaret T. Sharp
Executive Director
Milwaukee County Chapter
(Signed by) Mrs. Frank W. Porter
Director, Junior Red Cross

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN. HUNT
Hales Corners, Wis.

(*Continued from page 136 of the March, 1944, issue*)

Kneeling Pack Camel

The whittling job chosen for this month is both useful and ornamental, for the camel with its two panniers, shown in Figures 142 and 143, makes an excellent cigarette holder.

In whittling the camel, follow the routine of sawing out the silhouette, roughing out and then finishing. This will not be difficult if you study the various illustrations.

The sides of the camel, where the panniers or pack baskets fit, are left flat. The panniers are made of thin pieces of wood. Orange crate lumber dressed down smoothly was used on the one shown in Figure 143. The panniers, as you will notice, are open at the rear and top. They are put together with glue and small brads. After the glue has dried sand thoroughly, rounding off the edges as shown in Figure 143. Then cut a ⅛-in. mortise where the panniers fit against the sides of the camel, and glue them in position. Tie a cord around the two and let the glue dry thoroughly.

If you did not make too good a job of the mortising, fill in the openings with plastic wood. It will not be held against you in this case, as this project is not a cabinetmaking job. Sand the entire piece carefully. There should be no sharp edges.

Now for the finishing. Give the whole thing a coat of thin shellac and when dry, rub it down smoothly with steel wool. Then give it at least two coats of eggshell ivory enamel. This will produce a semigloss finish. We would advise leaving the bottom as is, that is unfinished, if you want your friends to believe you whittled it, because if you have enameled it carefully, your cigarette holder will look as though it were made of porcelain.

If you'd be wealthy, think of saving, more than of getting. — *Benjamin Franklin.*

Beware of little expenses; a small leak will sink a great ship. — *Benjamin Franklin.*

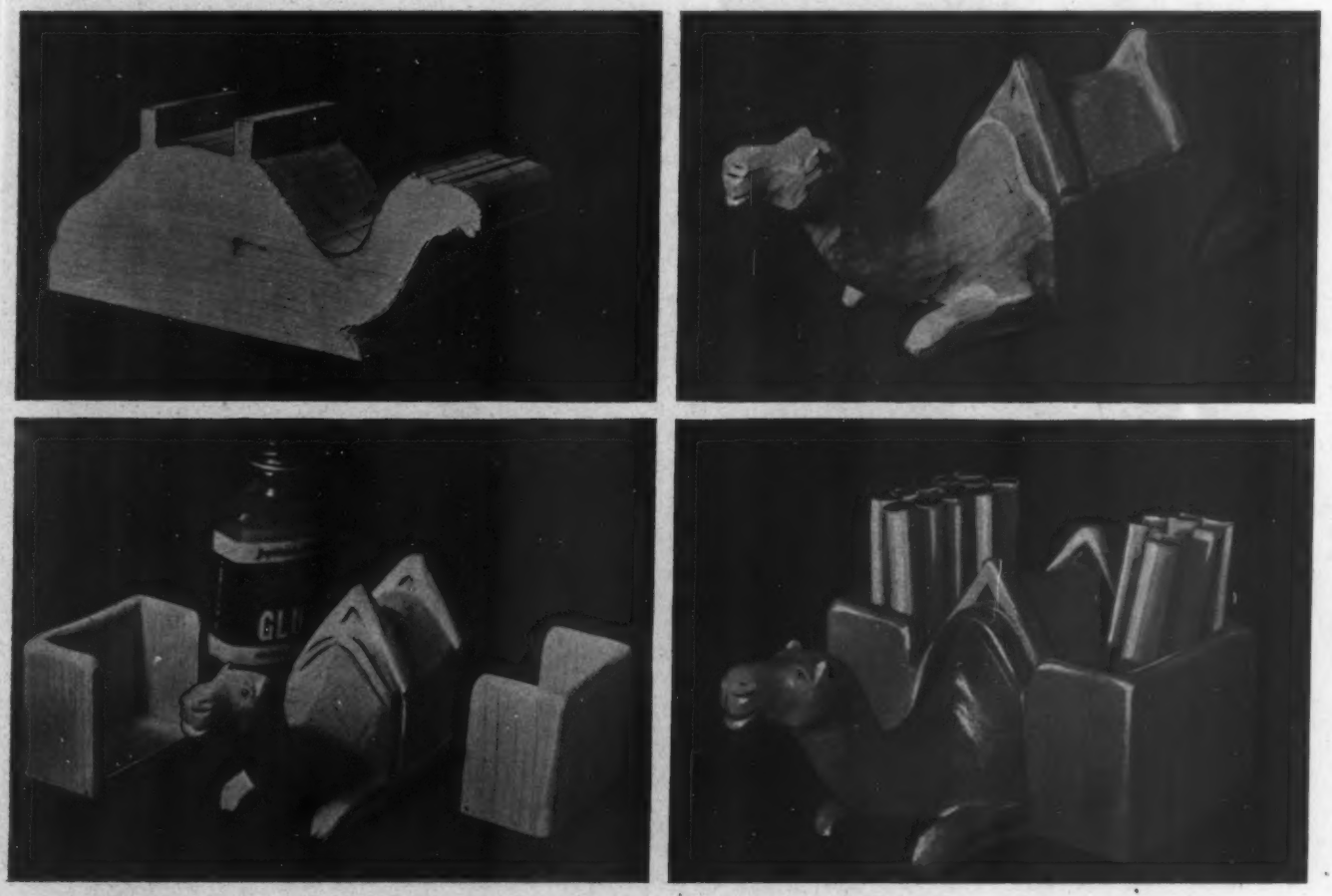


Fig. 143. The various steps in whittling the camel

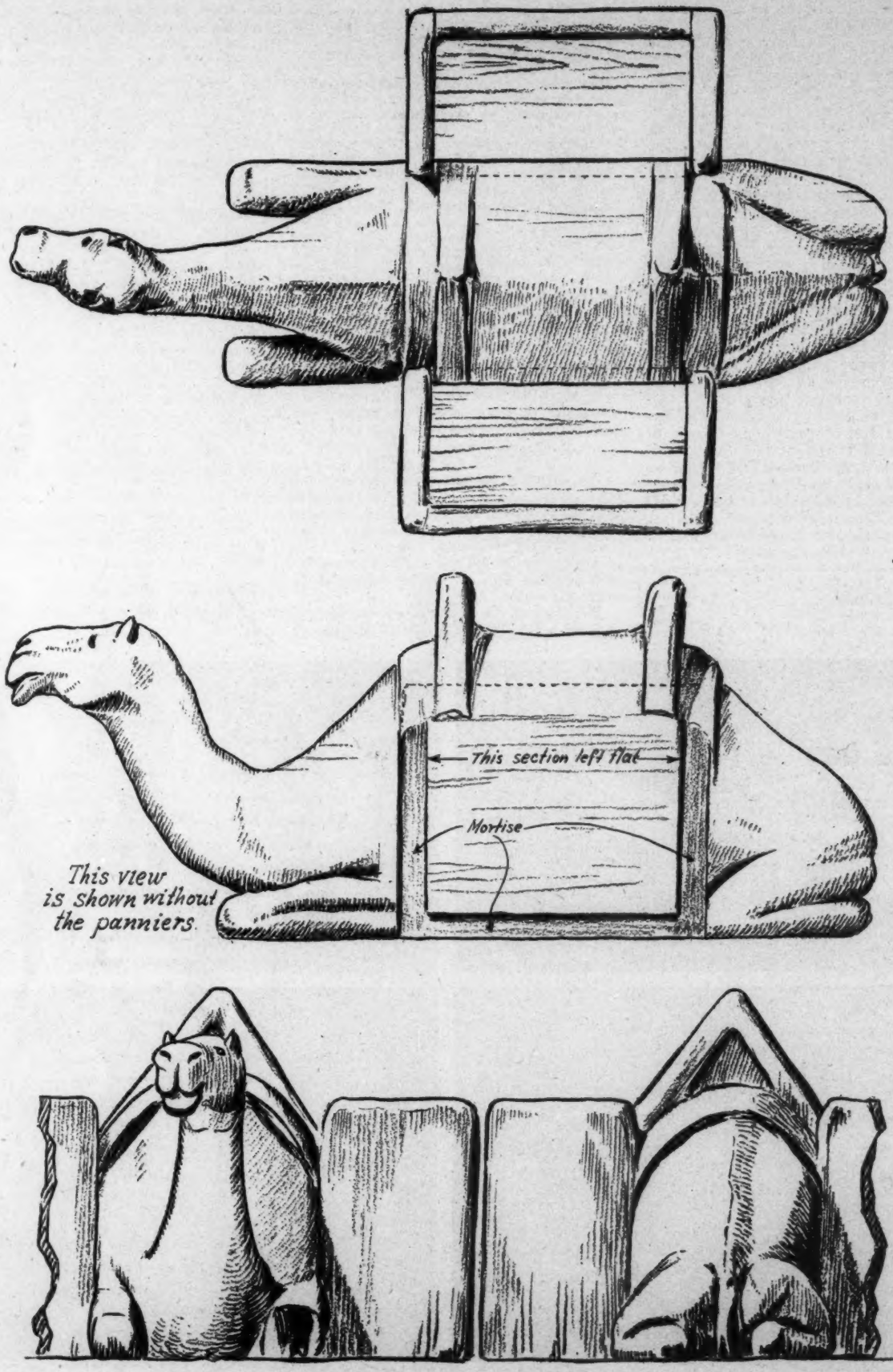


Fig. 142. Full-sized pattern of camel

JUNIOR RED CROSS WORK

The industrial-arts classes at the Mitchell Street School, Milwaukee, Wis., have made canes for the Red Cross for distribution to disabled servicemen. When the four hundredth cane had been finished, they sent it to President Roosevelt, while the 399 other canes were sent to the Milwaukee County Chapter of the American Red Cross.

Mr. George Heiden, the instructor, and his students are to be highly complimented on their fine civic spirit.

The following letters show that the work is deeply appreciated.

June 17, 1943

Mr. George Heiden
Mitchell Street School
23rd and West Mitchell Street
Milwaukee, Wisconsin

Dear Mr. Heiden:

Just a note of thanks to you for all the fine work you have done with your boys in Junior Red Cross. We are delighted with the many canes, and Headquarters in St. Louis tells me there is a great demand for them.

Canes made under your supervision have gone to Truax Field, Madison; Camp McCoy, Sparta; Veterans' Hospital, Wood; Foster Field, Texas; Army Air Base, Topeka; Chicago Air Force Training Command; and Fort Sill, Oklahoma.

I have written St. Louis for shipping instructions for the rest.

I am proud to send out the canes for they are so substantially and well made. Thanks so much for your help.

Sincerely,
(Miss) Margaret T. Sharp
Executive Director
Milwaukee County Chapter
American Red Cross
(Signed by) Mrs. Frank W. Porter
Director, Junior Red Cross

November 8, 1943

Hon. Franklin D. Roosevelt
President of the United States
Washington, D. C.

Dear Mr. President:

The boys in our industrial-arts classes of the Alexander Mitchell School have been making canes from discarded broomsticks and scrap pieces of wood. Three hundred and ninety-nine of these canes have been sent to the Red Cross for distribution to disabled servicemen in hospitals. The lads in these classes are much too young to fight, but sincerely hope that by making these canes, they are doing their part in this war. We decided to send the four hundredth cane to you.

Mr. Heiden, the teacher, has a son in the Marines stationed somewhere in the South Pacific, and knowing you to be a Marine Father too, we put the Marine Insignia on your cane. We hope that you will accept it with our best wishes.

Yours sincerely,
The Industrial-Arts Classes
By: James Stachowiak

December 18, 1943

My dear James:

The President is especially pleased to have the cane presented to him by you and the members of your Industrial-Arts classes. He has noted with interest all that you say in your letter of November eighth and wants you to know that he deeply appreciates your friendly thought of him.

The President asks me to convey his very best wishes to all of you for the Holiday season.

Very sincerely yours,
(Signed) Grace G. Tully
Private Secretary

James Stachowiak, Esq.
Alexander Mitchell School
Corner South 23rd and West Mitchel Streets
Milwaukee, Wisconsin

Proofreaders' Marks and How to Use Them

DONALD G. BROSSMAN

State Teachers College, Buffalo, N. Y.

Meaning	Marginal Symbol
small capital	
comma	
transpose	tr
quotation marks	
move left	[
invert	9
capital	≡
delete, take out	ℊ
period	⊙
broken letter	x
spell out	spell out
apostrophe	'
space evenly	
use ligature	fi
roman	rom.
move right	]
hyphen	
lower case letter	
push down space	
close up entirely	⁀
use less space	less #
no paragraph	no ¶
insert space	
indent 1 em	
straighten line	
italic	—
stet; let it stand	stet
wrong font letter	wf
bold face	bf
period	⊙
omission	
em dash	

Mark in Text	Marginal Symbol
PROOFREADERS' Marks are symbols	=
which, unfortunately, must be	'
learned largely by rote memory.	
This learning process can be short-	
ened, however, if the memorization	
can be coupled with the actual use	
of the marks. It is with this objec-	
tive in mind that this sheet has	
been developed.	
Errors necessitating the use of	
(32) of the most commonly used	
proofreaders' marks have been in-	
corporated into this sheet. They	
are used in such a way that the sym-	eg. #
bols, when properly filled in, will be	
closely linked to the error in the	
text material and to the explanation	
of the error. Since proofreaders'	
marks may be placed both to the	
left and right of the printed ma-	
terial, ~~space~~ has been provided to	
permit placement of the symbol on	
either side so as to have it as close	
to the error as possible.	
It will be noted that the text ma-	/ =
terial of this article is, in itself, an	
explanation of the proofreaders'	
marks. What makes this presenta-	lc
tion more useful than other similar	1
explanatory material is that the text	
carries a continuous thought, while	
others observed by the writer use	
only a single phrase repeated over	
and over.	
This not only is monotonous for	
the student but actually makes it	
impossible to illustrate some fre-	#
quently used symbols.	
As a final and extremely impor-	
tant thought, the printing instructor	
should look on this exercise merely	
as a guide to make certain that each	
symbol is thoroughly explained, ra-	
ther than a ~~device~~ to save himself	
the trouble of teaching the proof-	
readers' marks. He should make	
sure that each student uses the sym-	
bols properly under his direct guid-	
ance. Only in this way can an ade-	
quate understanding of these sym-	
bols be obtained the students.	
— *Donald G. Brossman*	

LINSEED OIL WOOD FINISH

EINAR E. SIRO
Fort Knox, Ky.

Linseed oil is not a new wood finishing material. It is one of the oldest, best, and easiest finishes to apply. However, during recent years its use has been overshadowed by other finishing materials, such as shellac, varnish, transparent lacquer, wax, and special sealers, as well as opaque lacquers, paints, and enamels. The present crisis has caused several of these materials to be placed on the hard-to-get list, while others have had essential ingredients replaced by inferior substitutes. Good brushes and several of the necessary abrasive materials needed to produce a good finish are difficult to secure. These shortages create definite finishing room problems, many of which can be solved by returning to the finish used by the *old masters*, linseed oil. Brushes are not needed to apply the oil nor abrasives to rub down the finish. Further consideration of the advantages and facts relative to linseed oil as a wood-finishing material, although not a cure-all, will justify its use by amateurs for years to come.

The oil finish is durable. It emphasizes the true beauty of the wood, producing a quiet velvety charm. Shellac, varnish, lacquer, and special sealers readily brighten the grain of the wood but at the same time they give the wood more of a glass rather than a wood appearance. These finishes become marred easily thus requiring constant care. The oil finish does not chip. It withstands considerable heat and moisture.

The shop instructor need not worry about a special finishing room when linseed oil is used. Oil is not affected by dust. The instructor can also forget about the runs, sags, streaks, brush marks, and rubbed-through spots so often found on student projects. They do not occur when using linseed oil. There will be no brushes to clean or worry about, nor steel wool and other rubbing abrasives to issue. A piece of cloth or waste plus student *elbow grease* is all that is necessary to apply the finish. Even the poorest student in the class can do a respectable job.

Linseed oil can be applied directly to the new wood, over stain, or over stain and filler. Additional coats of oil may be applied to the project at any time to freshen or build up the finish. Another advantage of an oil finish is that, if desired at a future date, it can be changed by applying a different type of finishing material over the oil. Thus, paint, enamel, shellac, varnish, or wax may be applied directly over the oiled surface. Before using lacquer, a seal coat of shellac should be used.

The oil finish, however, looks especially well on woods like walnut, butternut, chestnut, and oak. A little yellowish tint results when used directly (without staining first) on light woods, such as pine, poplar, and basswood. The oil has a tendency to darken the wood. Experiment with the oil by applying it on scrap pieces of lumber of which the projects are made to see exactly what the finish will be like. Stain some of the pieces before applying the oil. Pieces of wood of any thickness approximately 3 by 10 in. are very satisfactory for this purpose.

The finish is appropriate for projects like bookcases, tables, shelves, carvings, stands, and cabinets of various kinds. It is an ideal finish for candlesticks as it is not affected by wax or tallow. Linseed oil is one of the best finishes for a taboret or flower stand which is likely to come in contact with moisture. It works very well on projects or pieces that will be used outside, such as bows and arrows, skis, baseball bats, hockey sticks, and tool handles. It is an excellent finish for gun stocks. To finish wood kitchen utensils use olive, Wesson, or Mazola oil.*

It is advisable to use boiled linseed oil as it dries faster than the raw linseed oil. Raw linseed oil is the direct product of flaxseed and is very fatty and dries very slowly. Boiled linseed oil is the result of heating and treating the raw oil with certain chemicals to break down some of the fatty substance, thus giving it the property of faster drying. The boiled oil can be used directly on the project or thinned first with turpentine to give better penetration. Warming the oil also increases penetration. The first coat or two can be one part oil and two parts turpentine; next two coats, one part turpentine and two parts oil; and from there on pure oil. If desired all coats can be oil thinned with turpentine. The number of coats to apply will depend on the wood and the nature of the finish desired. Softwoods require more applications of oil than do hardwoods to produce the same sheen.

To apply an oil finish on wood without first staining or filling the following procedure works well.

1. Sand all surfaces of the project preparatory to finishing.
2. Apply boiled linseed oil to the surfaces of the project with a cloth or waste. The oil can be full strength or a solution from a third to two thirds turpentine. Be liberal with the oil. Allow 10 to 30 minutes time for the oil to thoroughly soak into the wood.
3. Rub all surfaces dry with a clean cloth. The more the surfaces are rubbed the better the finish. The surfaces may be polished by rubbing with the bare palm of the hand.
4. Allow the project to set overnight. In case the grain raised, sand lightly. Rub all surfaces thoroughly with a dry cloth.

If the finish appears dull and a more glossy surface is desired, repeat the foregoing procedure as many times as needed. The finish also can be built up by rubbing the project daily with a cloth slightly moistened with oil. The greater the number of applications of oil and the more rubbing that is done the glossier will be the finish. Care must be taken to remove all the oil after each application. Excess oil left on the surfaces becomes sticky. If this sticky oil cannot be removed by rubbing with a dry cloth, use one dampened with turpentine.

When water stain is used on the project it is necessary to first sponge the project lightly with warm water to raise the grain and open the pores of the wood. Allow to dry for an hour or more, and then sand lightly. This operation is beneficial when oil stain is used as well or when a plain oil finish is applied, although not necessary. Wood filler should be allowed to set 24 hours and sanded lightly before applying the first coat of oil.

Danger: Rags containing linseed oil are a fire hazard. Destroy the rags daily by burning or keep them in a good metal container.

*Siro, Einar E., "Finishing Wood Kitchen Utensils," Industrial Arts and Vocational Education Magazine, February, 1943, pp. 80, 84.

PLUG GAUGE

GEO. W. DEFFENDAHL
Central High School
Evansville, Ind.

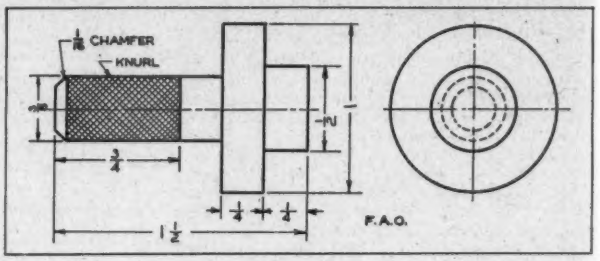
Material: One piece of 1¼ by 2½-in. cold rolled steel.

Tools: Cutter bit, knurling tool, micrometer, rule, outside caliper, and center drill.

Procedure:

1. Face and center on the lathe.
2. Turn to the largest diameter between centers.
3. Turn handle to size. (Allow for centers.)
4. Knurl handle.
5. Place large end in chuck and finish handle.
6. Place handle in chuck and turn the other end to size. (Be sure to place some material around handle to protect it.)

Note: All dimensions must be kept within .001 in.



Plug gauge

BRONZE TABLE LAMP

JAMES S. WISE
Community High School
Minonk, Ill.

This attractive bronze lamp will offer a challenge to skillful students in the industrial-arts general-metal shop or machine shop. The construction of this project will carry students into many phases of metalwork, and it will be a distinctive and decorative ornament for the home when completed.

The lamp was designed to be made of bronze, but other metals may be substituted. All of the materials, except the brass sheet metal for the base and shade, may be obtained at most junk yards. A bronze gear wheel, of which there will probably be various sizes, could be used for piece A.

Procedure:

1. Chuck piece A in the universal chuck. Face and shape one fourth of the cross section of the ring from the inside to the front face.
2. Reverse the work and repeat operation No. 1.
3. Reverse the jaws of the universal chuck and chuck the ring from the inside, using pieces of sheet metal to protect the work from the jaws. Face and shape the outside of the ring and then polish.
4. Construct a wood jig to hold the ring and drill the six 3/16-in. holes evenly spaced.
5. Turn hub and drill a 5/32-in. hole through center of it.
6. Construct a wood jig and drill six 5/32-in. holes evenly spaced around the circumference of the hub, and tap out holes with 10–24 n.c. tap.

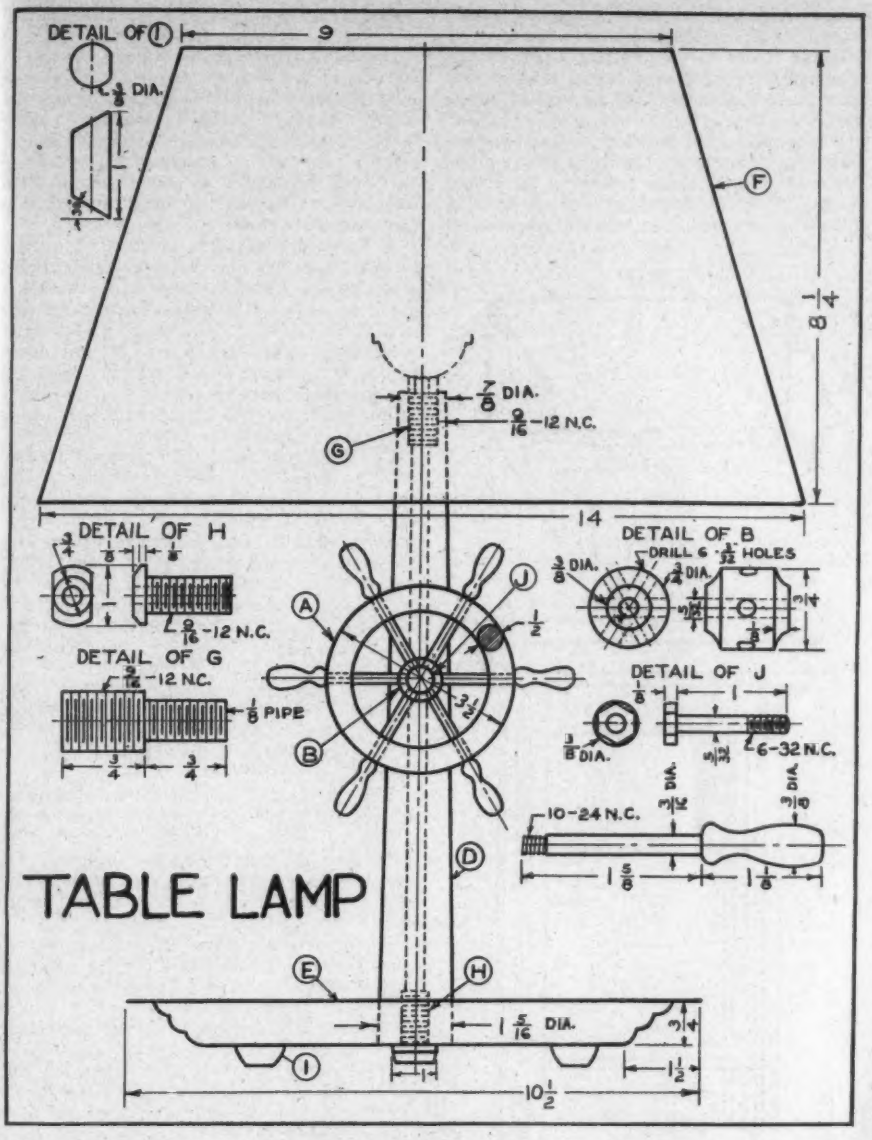


Fig. 1. Details of lamp

Fig. 2. Silhouette for shade

Fig. 3. The finished lamp

7. Turn six handles to the dimensions given in the detail drawing and thread with 10–24 n.c. die and polish.

8. Assemble the wheel.

9. Chuck piece D between centers and true up a portion in the center.

10. Mount center rest on lathe and adjust to work.

11. Drill 3/16-in. hole through center.

12. Turn taper by setting tailstock over 1/2 the difference between the diameters of the large and small end.

13. Drill a 1/2 by 3/4-in. hole in each end of D and tap 9/16 in. 12 n.c.

14. Turn and thread connection for socket as shown in detail.

15. Turn and thread cap screw to fasten lamp stock to base and drill for cord, as shown in detail.

16. Turn a form of wood (preferably maple) to the size and shape of the inside of the base for spinning base. Consult a good reference before spinning base.

17. Turn a piece of bronze 3/8 in. in diameter by 3 1/2 in. long.

18. Cut into 3 pieces 1 in. long and form beveled ends and flat top surfaces as shown in detail.

19. Space these evenly on base and sweat to base with 40–60 solder.

20. Turn the 5/32-in. supporting shaft for the wheel and lay out and file a hexagonal head.

21. The shade is to be made in three pieces. Develop pattern, divide into three parts allowing for 1/8-in. grooved seams and No. 14 wire in edges. Cut out the three pieces.

22. Each section is to have the accompanying silhouette pierced in it. Fasten the three pieces between two pieces of 1/4-in. plywood and pierce with the jig saw.

23. Fold, groove, and set down seams.

24. Wire top and bottom edge.

25. Construct a wire clip to support shade from light bulb.

26. Assemble lamp, polish, and give one coat of clear lacquer.

BILL OF MATERIAL

No. of pcs. required	*Part*	*Material*	*Size*
1	A	Bronze	1/2 x 3 1/2 dia.
1	B	Bronze	3/4 x 3/4 dia.
6	C	Bronze	3 x 3/8 dia.
1	D	Bronze	12 x 1 1/2 dia.
1	E	Bronze	12 x 12 in. No. 20 gauge
1	F	Brass foil	12 x 42
1	G	Bronze	1 1/2 x 5/8 dia.
1	H	Bronze	1 1/2 x 1 dia.
3	I	Bronze	1 x 3/8 dia.
1	J	Mild steel	1 3/16 x 3/8 dia.

CABINET DRAWING

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South High School
Minneapolis, Minn.

Someone has said that written language was the greatest invention of the human mind and as a means of expression it is of the greatest value. That our intricate and highly developed civilization would be impossible without this valuable means of conveying information, from one person to another, is certain.

By means of written words we are able to describe objects, narrate events, and even make known to others our thoughts and feelings.

However, drawing is also a means of expression, older even than written language, and often may be used as a supplement to written or spoken language and when used in the description of objects may be the equal if not the superior of language as a tool.

This may be observed by one who is associated with men engaged in mechanical work. Almost instinctively the engineer or draftsman resorts to the use of the pencil when called upon to describe some machine or device and the only thing that prevents more frequent use of drawing by many other people is the fact that they have not developed the ability to make use of this valuable means of expression.

A moment's reflection will enable one to see how inadequate and cumbersome written words are as compared to drawing in describing objects.

The attempt to describe in words even a very simple object will show that a sketch will usually mean added clearness and a saving in time.

For the engineer, designer, and mechanic a knowledge of the system of drawing in orthographic projection known as mechanical or technical drawing is indispensable. Mechanical drawing is the language of industry and the man who is unable to read and understand this type of drawing will be seriously handicapped in practically all mechanical fields.

While mechanical drawing is of great value to the engineer and mechanic it has the disadvantage that it is not readily understood by those who have not spent a considerable amount of time in learning to read it.

Pictorial drawing, on the other hand, may be understood by anyone and in many cases the ability to make a satisfactory pictorial drawing may make it possible to explain more quickly and clearly some device or machine to a person not familiar with the rules of mechanical drawing.

Pictorial drawing is a great help in clarifying ideas and is often used by designers in the first stages of the work of planning some new machine or attachment.

Figure 1 is a copy of an actual drawing presented to a cabinetmaker in an attempt to explain how a table should be made.

When after a considerable waste of time a fairly clear idea of what was wanted was obtained, it developed that the table should actually look like the one shown in Figure 2.

If the maker of this drawing had ever had a rudimentary idea of pictorial drawing, he could have explained what he wanted much better.

Perspective drawing is the best of the several systems of pictorial drawing and if properly made it gives a true picture of the object drawn and much resembles a photograph. It can be understood by anyone and requires no training, on the part of the observer, to interpret.

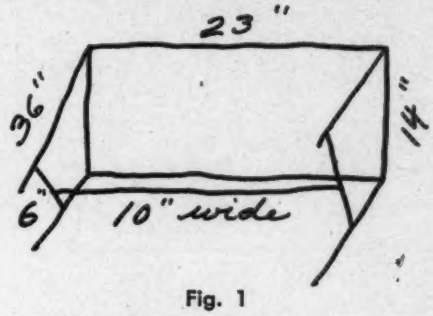


Fig. 1

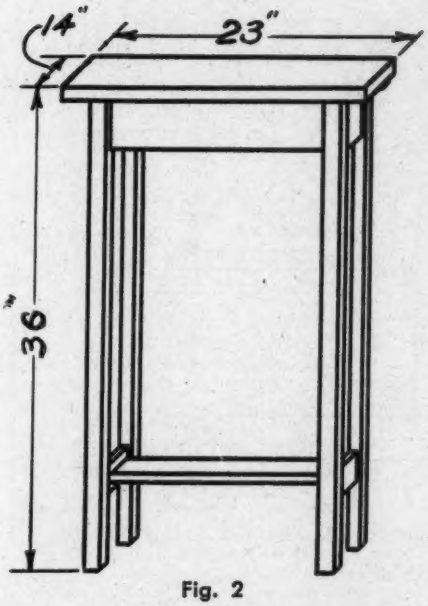


Fig. 2

However, acquiring the ability to make a correct perspective drawing requires a considerable amount of time and study and the actual making of a true perspective drawing takes so much time that several methods of making approximate perspective drawings have been developed. The most used of these methods are oblique, including cavalier, cabinet, and isometric.

A knowledge of these systems of making pictorial drawings may be of value to almost everyone and such knowledge will serve as an excellent basis for instruction in making true perspective drawings. In addition a familiarity with the rules of cabinet and isometric drawing is of value in school drafting rooms as this knowledge may be used to test the ability of the pupil to read a blueprint or drawing made in orthographic projection.

The pupil may be given a pictorial drawing and instructed to make a working drawing from it or the pupil may be given a working drawing and be asked to translate this into a pictorial drawing. Some instruction in making pictorial drawings given in the high school could well be justified on this basis alone.

The foregoing reasons for teaching pictorial drawing are sufficiently important to warrant some time being spent on this phase of drawing.

A few suggestions may be made as to how cabinet drawing may be taught. Since drawing presents fewer difficulties than either of the other two systems it may well be taken up first.

Cabinet drawing is one of the subdivisions of oblique drawing. In oblique drawing the object to be drawn is assumed to be placed with one side parallel to the observer. The receding lines representing edges of the object that are perpendicular to the front surface are drawn parallel to each other.

These receding lines may slope at any angle, but quite commonly 30-, 45-, and 60-degree angles are used because the draftsman has these triangles at hand.

The effect of using the different angles may be seen in Figure 3.

The object may be placed below the level of the eye of the observer and either to the right or left of him or it may be placed above the eye. These different positions are shown in Figure 4. The second one is more often used.

The objects appear as if placed in a some-

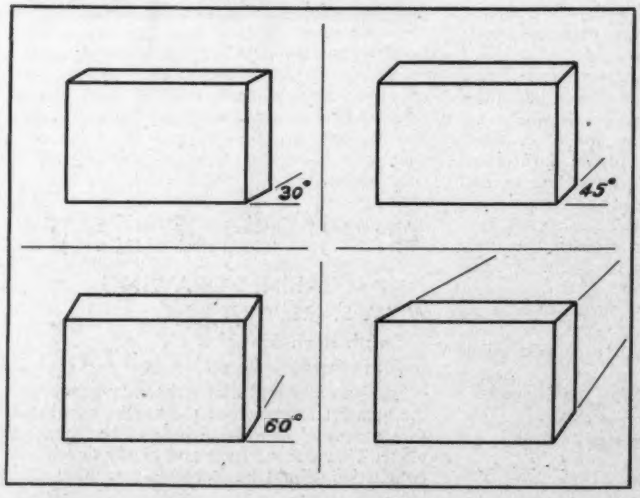


Fig. 3

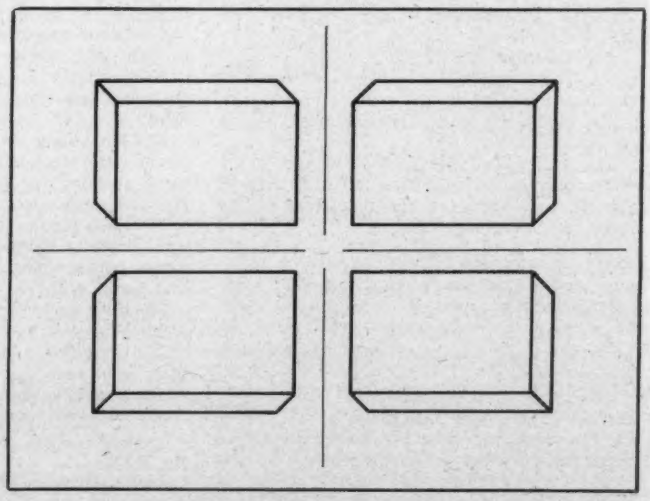


Fig. 4

what different position in relation to the observer, but otherwise are the same.

The several steps of procedure are shown in Figure 5.

Draw the outline of the front view. Draw the receding lines at an angle of 45 deg. of indefinite length. Draw the lines representing the back edges of the block.

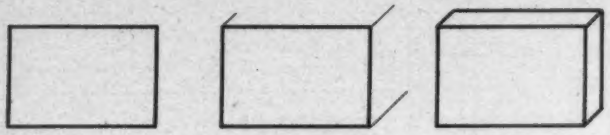


Fig. 5

These drawings violate one of the laws of perspective drawing.

According to a rule of perspective drawing, objects appear smaller if they are farther from the eye.

In order to make a true perspective drawing, the lines representing the farther edges of the rectangular blocks would have to be drawn shorter than the lines showing the front or nearer edge.

Drawing these lines the same length produces a distorted appearance, which is one of the objections to oblique drawing. Also the receding lines would converge in a perspective drawing and the length of the receding lines would be less than their true length.

In spite of the distortion caused by drawing the receding lines parallel instead of converging, this type of drawing gives a fairly clear idea of the shape and proportion of the block and if one works much with these drawings the distorted effect becomes less and less disturbing.

As the distortion increases with the length of the receding lines the object should be drawn with the longest dimension parallel to the observer as shown in Figure 6.

Fig. 6

Cavalier drawing is the name applied to one form of oblique drawing. The receding lines slope at 45 deg. and all lines are drawn the true length.

As a true perspective drawing would have the receding lines foreshortened, drawing these lines the true length has the effect of making the object appear too thick.

In cabinet drawing, which derives its name from the fact that it is much used by cabinetmakers in drawing furniture, an attempt to overcome the objection of cavalier drawing is made by adopting an arbitrary rule that all measurements on the receding lines be one half of the true length.

This makes a more pleasing drawing as may be seen by comparing the two drawings of a cube in Figure 7. This drawing on the left has the receding lines the full length while in the drawing on the right ½ the true dimensions are used on the receding lines.

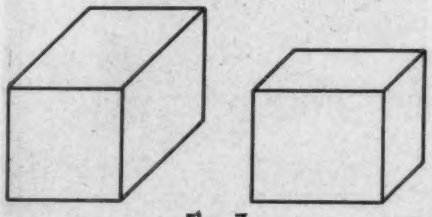


Fig. 7

Instead of one half, the values of one third or two thirds of the true length also are used as measurements of the receding lines. One half the true length should be used on these plates.

When dimensions are placed on cabinet drawings, the figures showing the length of receding lines are those of actual sizes of the object in spite of the fact that these lines are only ½ of the true length on the drawing.

This point is very likely to be overlooked or misunderstood by pupils and care should be taken by the teacher to test the results of instruction regarding this point.

Circles on the front surface of the object are drawn with the compass and appear as true circles, but circles on the top or sides of the object show as ellipses and are often drawn freehand. It is better to select for cabinet drawing objects that do not have circles on more than one view and to place the object so that this is the front view in the drawing.

If it is necessary to draw circles on the top or side of the object it should be remembered that the ellipse showing the circle will have a length equal to twice its width as shown in Figure 8.

Other methods of drawing ellipses are similar to that used in drawing ellipses in isometric drawing. A four center method is used that approximates the true projection.

Many objects do not work out well in cabinet drawing and should be avoided or reserved to be drawn in isometric or perspective drawing.

The instructor should tell the class the advantages of developing the ability to make pictorial drawings and then explain the process after which pupils should draw simple exercises in order to fix in their minds the rules of cabinet drawing.

Simple rectangular blocks will do very well for the beginning exercises, and if the purpose of these preliminary plates is explained to the class no lack of interest is likely. Exercises have the advantage that they center the attention on the one point to be taught.

For the first plates the drawings should be made of blocks of such size and proportion as will look well on the sheet. The dimensions of the blocks should be such that no time will be wasted. Blocks of even inches, halves or quarter inches will be drawn more quickly than if such dimensions as 16ths or 32nds are used.

Time may be saved by giving the pupils definite directions regarding spacing instead of requiring them to calculate the spacing for themselves.

Spacing of cabinet drawings evenly on the sheet presents a difficulty for beginners, because they can not tell how much distance horizontally is needed to allow for a given distance measured on the sloping line.

One way to avoid the difficulty encountered in getting correct spacing is to use a sheet of paper slightly larger than the size of the desired finished sheet, as an 11 by 15 sheet when a 9 by 12 sheet is the finished size. If the larger sheet is used, the border lines may be drawn after the picture is completed, thus securing an even margin on each side. After pupils have made a few cabinet drawings they will learn to space correctly.

Fig. 8

(to be continued)

HAND BRAKE FOR SHEET-METAL SHOP

GEORGE WELCH
Corfu, N. Y.

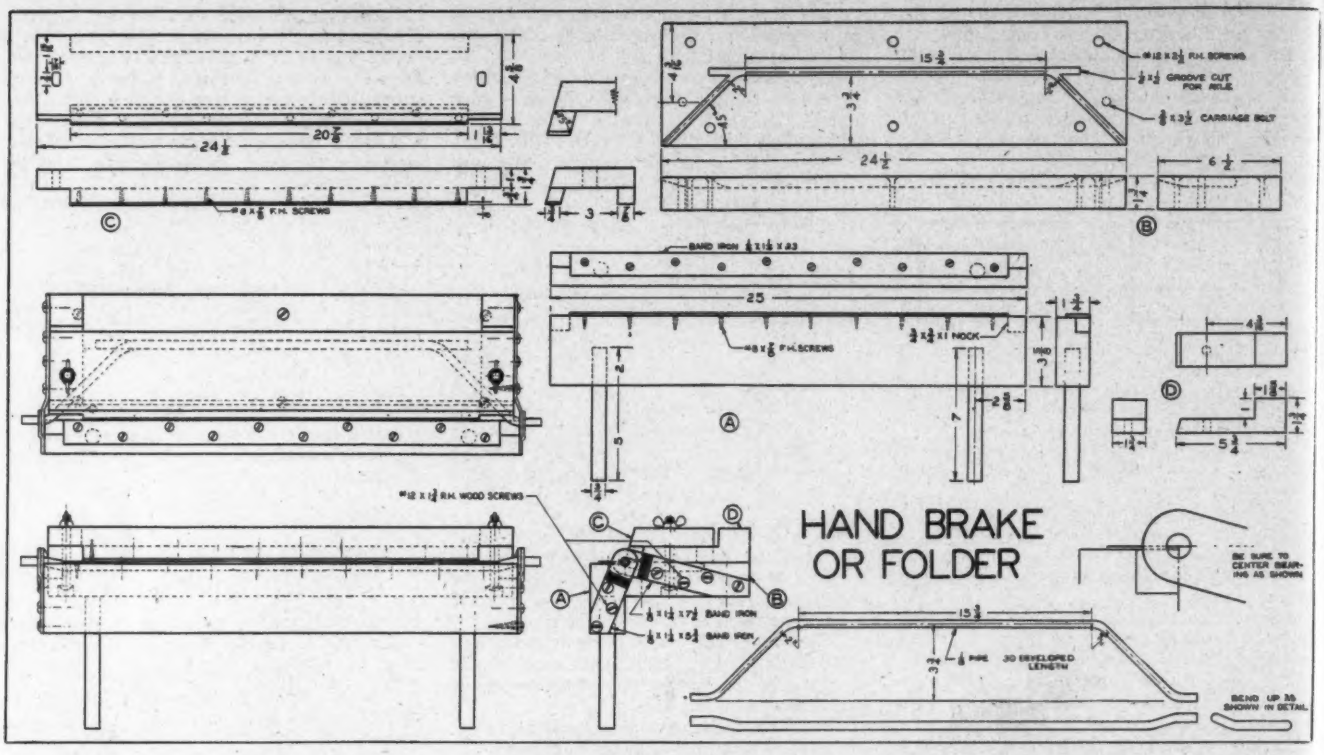
The brake illustrated and described herein was built of birch, although white oak or maple would have answered the purpose as well.

BILL OF MATERIALS

No. of pcs.	*Part*	*Material*	*Size*
1	Part A	Birch	1¾ x 3⅝ x 25
1		Band iron	⅛ x 1¼ x 23
2	Bearing	Band iron	⅛ x 1¼ x 5¾
1	Part B	Birch	1¾ x 6½ x 24½
2	Bearing	Band iron	⅛ x 1¼ x 7½
1		W. I. pipe	⅛ x 30
1	Part C	Birch	1¾ x 4⅝ x 24½
1		Band iron	⅛ x ¾ x 20⅞
2	Part D	Birch	1¾ x 1¾ x 3⅞
14		r.h. screws	No. 12 x 1¾
20		f.h. screws	No. 8 x ⅞
6		f.h. screws	No. 12 x 2½
2		Carriage bolts	⅜ x 3½

The most important and difficult step in making the brake is to get the bearings exactly centered as shown in the illustration. Make sure the holes drilled through the bearing for the 1¾-in. r.h. wood screws are a snug fit. Fasten the bearing in place as nearly correct as possible with two smaller (No. 8 by ¾-in.) r.h. wood screws. This will permit the moving of the bearing until it is lined up exactly correct. Then tighten these two screws, and put in the pilot holes for the No. 12 by 1¾-in. screws. After the larger screws have been screwed down tight, remove the small screws, redrill, and replace these with No. 12 by 1¾-in. screws.

Hand brake



Details of hand brake

By following this procedure you will find that the bearings will be very nearly exactly centered. If there is a little inaccuracy after the bearings are screwed down, it can be corrected by either increasing or decreasing the offset on one or more of the bearings.

A SIMPLE SLIDE PROJECTOR

HAROLD GLUCK AND
CHARLES SULLIVAN

William Howard Taft High School
New York City

There are a variety of projectors on the market. Some of them will show standard slide films, others the 35mm. strip films, and still others, color transparencies.

It is possible to build a good projector without using condensing lenses. The one shown in Figures 1 and 4 was built at a cost of about 50 cents and was satisfactory in every detail. We wanted one that would show either color transparencies or the black and white film single shots taken with a camera.

Three tin cans are needed to construct this simple projector. One of these should be a can about 4 in. square, and 6 in. high like the one shown at 1 in Figure 1. Another one (shown at 5) should be about 4 in. in diameter and 6 in. high. The third one (part 6 in Fig. 1) should be 3 in. in diameter and 4 in. high.

The large can is the lamp house, the other is the barrel, and the small one is used for the lens mount. At a hardware store or at a dime store get a flush socket for a kitchen fixture. Insert the socket in a hole in the bottom of the square can.

Next, cut out three pieces of ¼ by 6 by 6-in. plywood, for parts 2, 3, and 4, as shown in Figures 2 and 3. Cut a 2-in. square hole, in parts 2 and 4. Fasten quarter round to part 2 so that the lamp house may be attached by a friction fit. See Figures 1 and 2. Do not make this a permanent joint as the can must be removed to insert the 100-watt bulb which will supply the source of illumination.

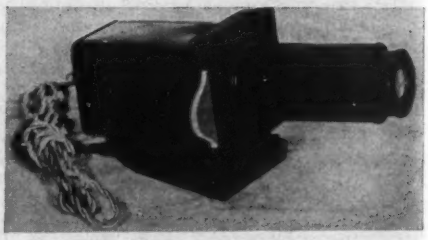


Fig. 4. The assembled projector

Cut part 3, Figures 1 and 3 into a *U* shape, as shown. This is the center piece and will take the slide carrier.

Cut a 2⅛-in. square hole into the bottom of the second can (part 5, Fig. 1) and then fasten the can firmly to part 4, as shown in

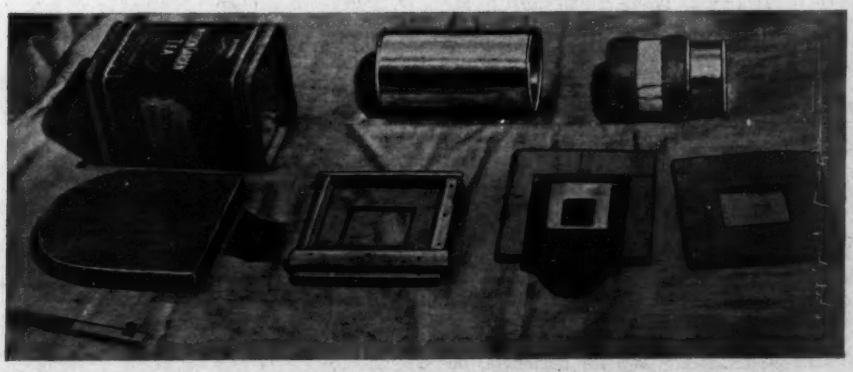


Fig. 2. The parts needed for making the projector

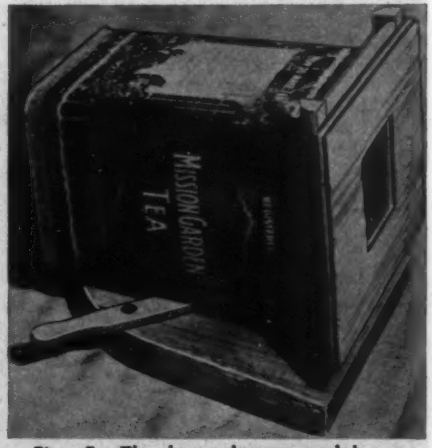


Fig. 5. The lamp house and base of the projector

Figures 1 and 7. See that the opening in the can is opposite the square hole in the piece of plywood.

Using four nails or screws, fasten the slide carrier between the lamp house and barrel supports as shown in Figures 1 and 6. Cut out the base piece as shown in Figure 3. Fasten a small hinge to the end of this base and to the front of the barrel support. See Figure 7.

Purchase a dime store hand magnifying glass about 1 or 1½ in. in diameter. The cost will range from 15 to 50 cents. The one used in the author's projector cost 15 cents. Next, determine the focal length of this glass. In order to do this, move the glass forward and back between a sheet of white paper and the window. You will get an inverted picture of the view from the window. Take a ruler and measure the distance from the lens to the paper. This is the focal length of the lens, and is the distance the lens must be from the transparency which is to be projected. It may be necessary to reduce the length of the barrel can to accommodate the lens.

Take the third can (part 6 in Figs. 1 and 8) and paste strips of newspaper around it to increase its outside diameter until it just slides into the barrel. Cut a hole smaller than the lens in the bottom of the can. With a tin snips or a sharp knife cut four tabs from this and bend them outward from the can. Then rest the lens on the ridge in the bottom and bend the tabs down on the lens to hold it in place. See Figures 1 and 9. Cut a ring of paper and glue it over the front of the lens mount to seal any light cracks, as shown in Figure 9.

Cut out the two pieces of 2⅛ by 3-in. heavy

Fig. 6. Lamp house support, slide receiver, and barrel holder

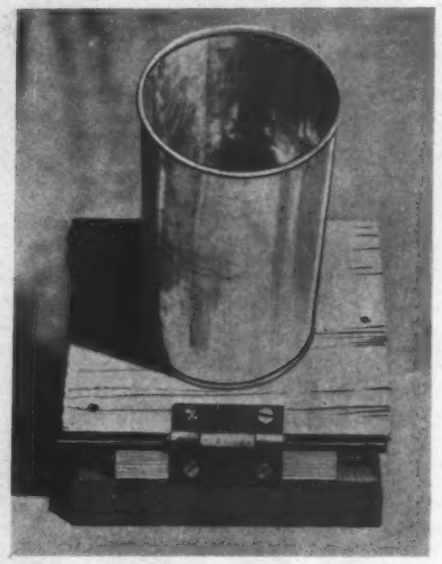


Fig. 7. The barrel fastened in place

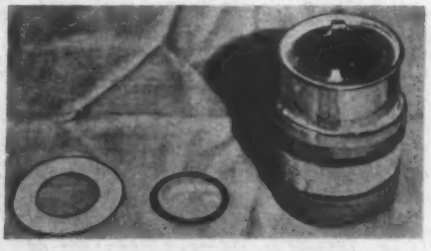
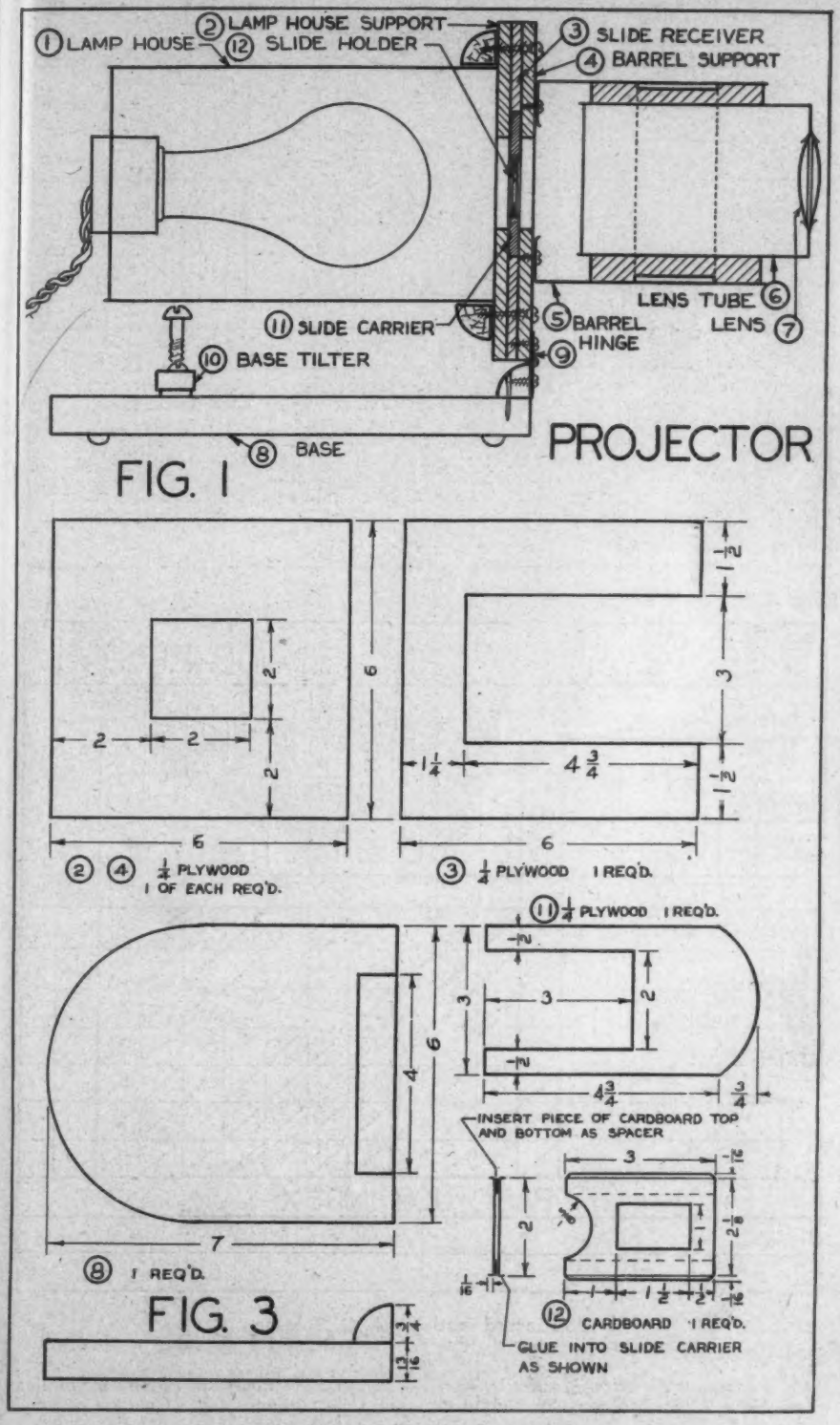


Fig. 8. The lens and the lens tube



Assembly and details of projector

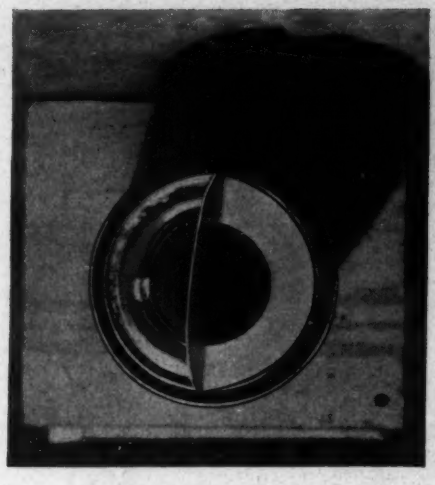


Fig. 9. The lense fastened into the lens tube

paper, shown as part 12 in Figure 3. Bend down 1/16 in. along the length of each side. From a piece of ¼-in. plywood cut a piece 5½ by 3 in. for the slide carrier, shown as part 11 in Figure 3. Centered from side to side, cut a slot in this piece 2 in. wide and 3 in. deep. In this space glue the two pieces of cardboard with the 1/16-in. flanges facing outward, as shown. Before gluing the two pieces into place, insert the spacers called for in the illustration of part 12 in Figure 3. This is the holder for the transparency slides.

Connect wires and a plug to the socket. In order that the inside of the lamp house may best reflect illumination, coat it with aluminum paint. Insert a 100-watt bulb in the socket, paint the outside of the cans black, and the result is a good serviceable projector at very little cost.

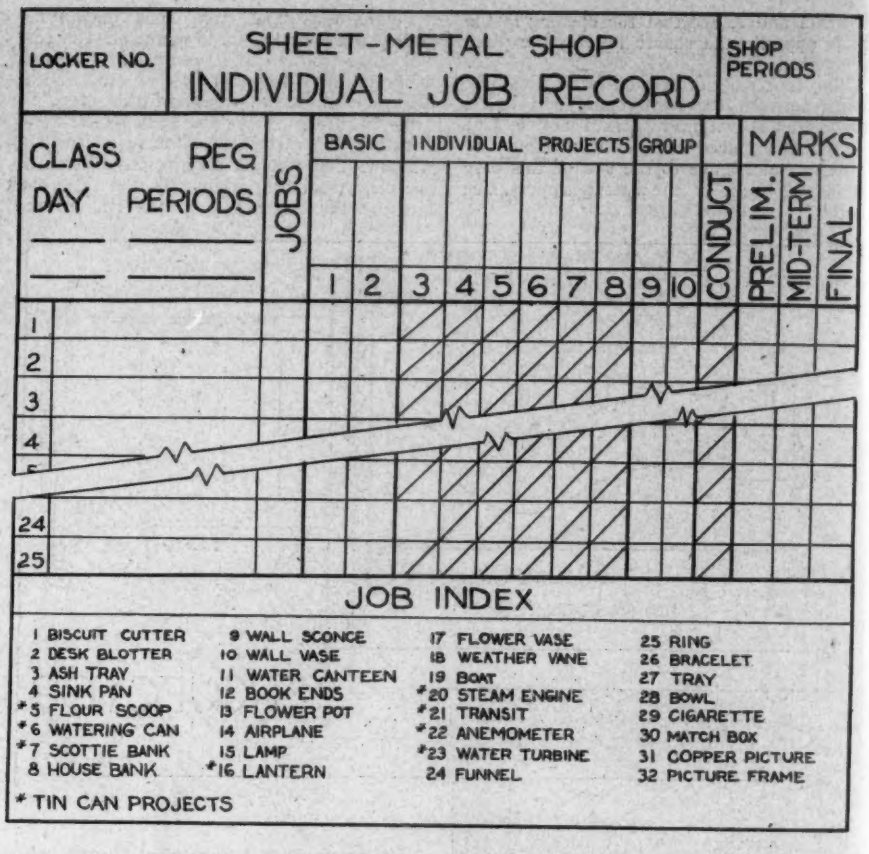
JOB RECORD CARDS

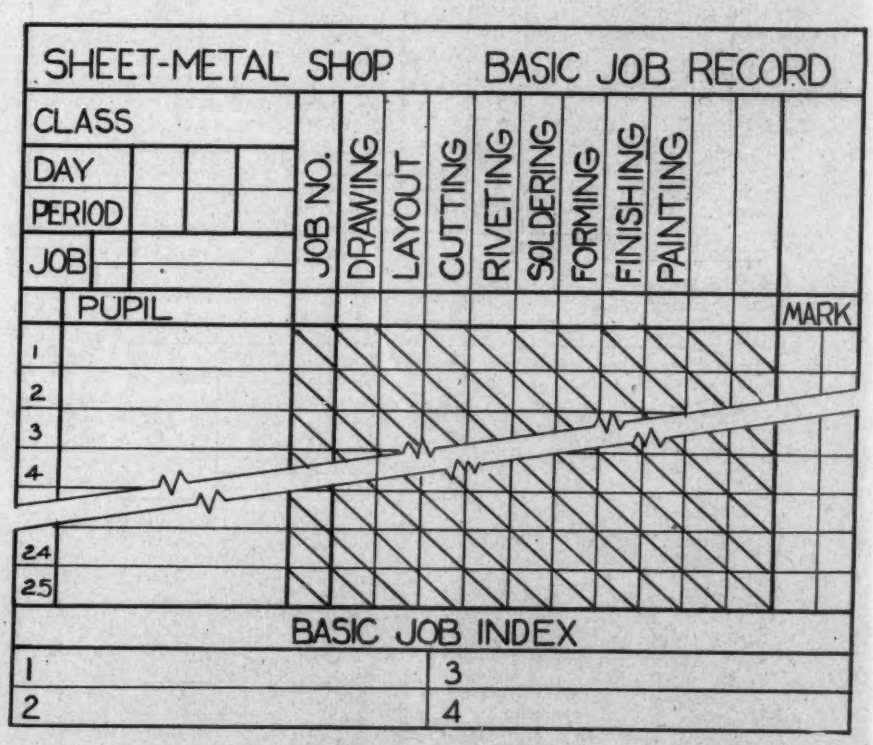
A. G. BELESON
Public School No. 139
Manhattan, N. Y.

The two record cards presented are adaptable in almost any school shop. The basic job record card is used for recording information about those projects which the teacher selects for the student, while on the individual job record card are recorded all the projects which the individual student selects for himself.

The number of the project is always recorded in the upper section of the box, while the lower section is used for the mark given the student on his work.

As there are three marking periods, each mark is recorded in its respective place. The conduct mark is divided by the diagonal, the upper half for the *preliminary* conduct mark, and the lower half for the *mid-term* mark.





Job record cards by A. G. Beleson

ADDITIONAL REFERENCES

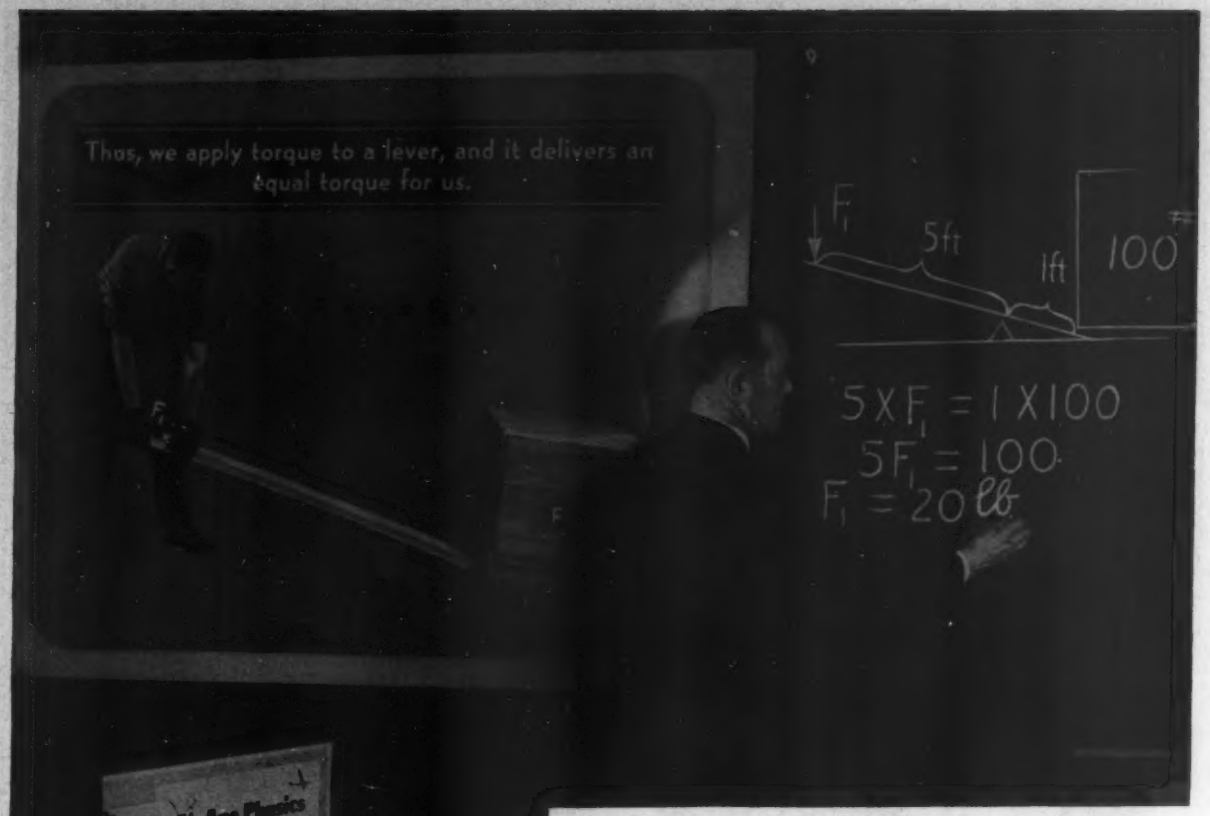
The following references were omitted from last month's issue. They are part of Tilden Collar's article and should be added to those given on page 116.

15. *Mathematics for Electricians* by Kuehn (New York City: McGraw-Hill Publishing Company).

16. *Automotive Electrical Practice* by Kuns (New York City: McGraw-Hill Publishing Company).

17. *A First Course in Physics* by Millikan and Gale (Boston, Mass.: Ginn & Company).

(Continued on page 33A)



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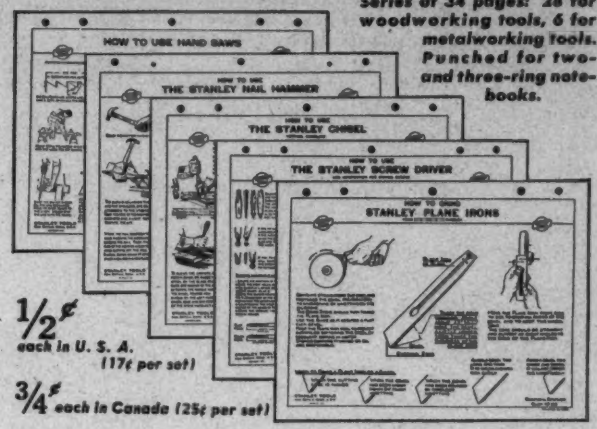

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Personal News

♦ JERRY R. HAWKE has been appointed Deputy Assistant U. S. Commissioner for Vocational Education, U. S. Office of Education, under Dr. J. C. Wright, Assistant U. S. Commissioner for Vocational Education. Mr. Hawke succeeds John J. Seidel of Baltimore, Md., who recently returned to his duties as assistant state superintendent of schools in Maryland.

♦ HOMER C. ROSE, formerly connected with the Teacher Training Department, Armored School, Fort Knox, Ky., and more recently a private in the army, has been discharged from the army of the United States for the convenience of the government to accept a commission as Lieutenant (jg) in the United States Naval Reserve.

The commission was granted on February 23 and on March 25 Mr. Rose will report to Princeton University for two months' training before being assigned to duty.

♦ L. R. EVANS, former director of vocational education in Sheboygan, Wis., died at his home February 2. For many years Mr. Evans was one of the leaders of vocational education in Wisconsin, and he was responsible for the organization of the Vocational School at Sheboygan.

He was well known at The Stout Institute, where he attended school on several occasions, and he also spent several summers employed as a teacher there. Due to ill-health Mr. Evans had not been active for the past two years.

♦ DR. HENRY B. MCDANIEL, vocational guidance director and psychologist for San Diego, Calif., city schools, has accepted the position of California State Vocational Director and is now stationed in Sacramento.

♦ MISS ANNA CATHERINE MOSER, formerly of State Teachers' College, Mont., and since last September, a history teacher for the city schools of San Diego, Calif., has been named to replace Dr. Henry B. McDaniel as vocational guidance director and psychologist for San Diego.

♦ MARIAN EVANS, director and founder of San Diego's Visual Education Center, at San Diego, Calif., has taken a year's leave of absence to do work in the Visual Education field for the government. She will direct and assist in preparing training films for the military personnel.

♦ DR. FORREST E. LONG, chairman of the Department of Secondary Education at New York University, has been named director of the School and College Division of the National Safety Council. He succeeds Miss Marian L. Telford, who has moved to the Council's Field Organization Department.

♦ LIEUT. (jg) TED D. SATHER, a teacher at the school of vocational and adult education at Kenosha, Wis., has been granted a commission in the naval reserve, and has begun his duties at Pensacola, Fla.

♦ ENSIGN FRED G. SCHROEDER has received a commission in the naval reserve, and reported at Hollywood, Fla., March 1, to take up his work. Mr. Schroeder was music instructor at North High School, Sheboygan, Wis.

♦ HUGH P. HARSHBARGER has recently been appointed liaison officer of the new Douglas Aircraft school at Des Plaines, Ill., by the Superintendent of Schools, Frank L. Holmes. The new school is operated by the high school under the State Vocational department. Mr. Harshbarger will be on leave part of the day from his high school duties to supervise this program, which will employ 45 full-time instructors.

♦ E. S. DONALDSON, instructor in sheet-metal work at the Vocational School, St. Paul, Minn., retired from teaching service last June. He had been a member of the teaching staff of this school since it was first organized in 1919. Previously, he had been instructor in the Boys' Industrial School, which was located in the Madison School.

'Tis hard for an empty bag to stand upright. — *Benjamin Franklin.*

Association News

♦ The New Jersey Vocational and Arts Association will hold its convention March 23 to 25, at the Hotel McAlpin, New York City.

♦ The convention of the Eastern Arts Association will take place at the Hotel Pennsylvania, New York City.

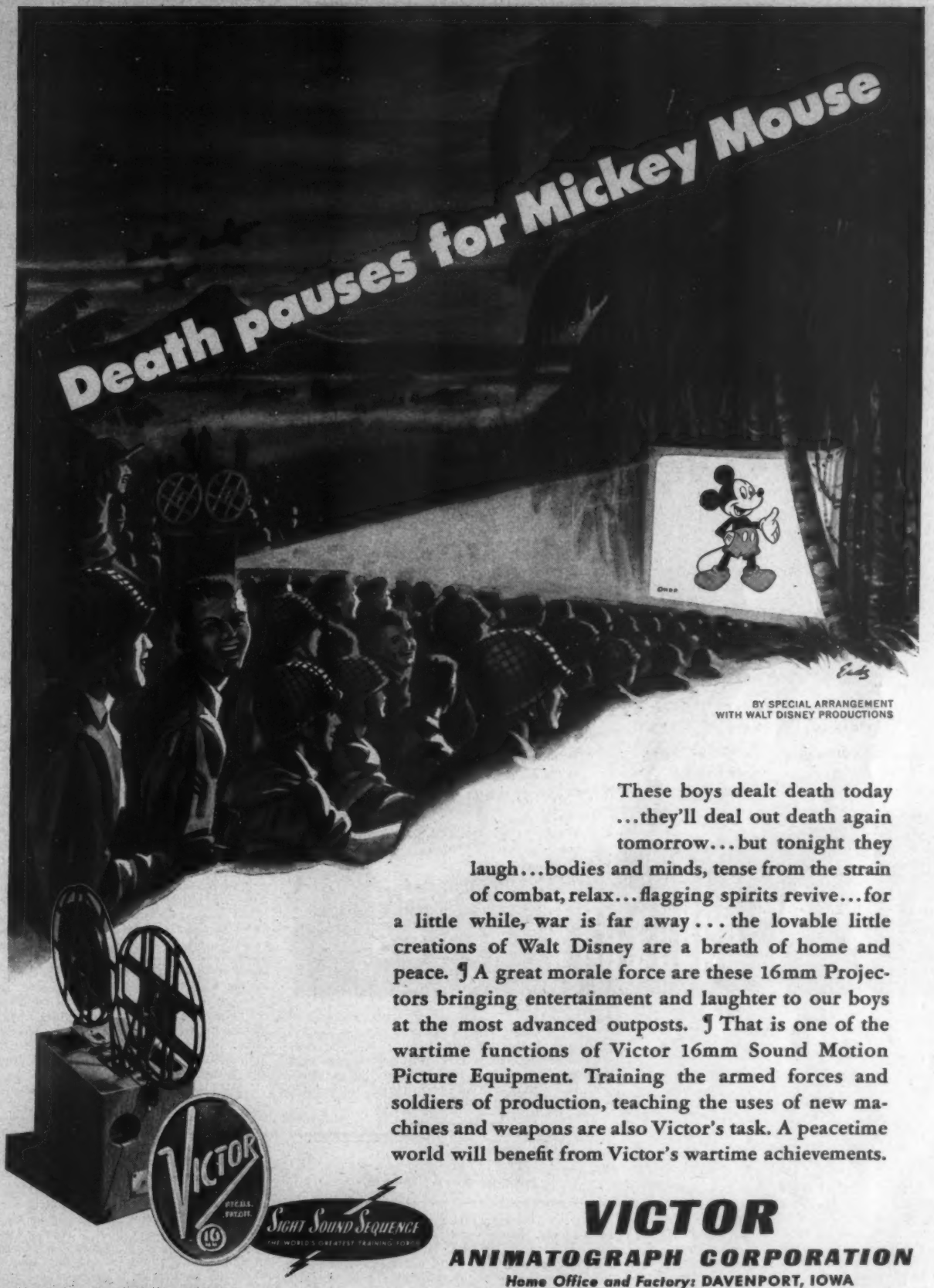
♦ The Bergen County Industrial-Arts Club of New Jersey has appointed new committees for the year. They are: Programs and Banquet Committee: chairman — Howard Barret; John Steimstra. Nominating Committee: chairman — Arthur Stone; Leslie Wilding, Howard Barret. Membership Committee: James Worden, Vincent Steckline, Wladiphaw Metyl, Emil Lang, Daniel Conte, George Egli, John Browning, and Harry DeArmott. Legislation: chairman — Charles Goodyear; Arthur Stone, and Ralph Knettle. Publicity and Paper: chairmen — Leslie Wilding and John Mangan; Albert Weinemann, C. L. Ceyer, Lloyd Hughes, P. Paige, and L. Frye.

These groups with their committee chairman keep the programs alive. Under the guidance of Mr. Robert A. Campbell, state supervisor of industrial arts, Trenton, N. J., they have begun a course in plastics. Mr. Ernest De Wick of Rahway, N. J., will conduct this course. This class meets every Friday afternoon from 4 to 6:00 p.m., at the Teaneck Junior High Shop. — *John F. Mangan.*

♦ The convention of the Western Arts Association will be held in Detroit, on May 3, 4, and 5, with headquarters at the Hotel Statler. This is the annual meeting of the organization, being held after a lapse of one year.

The convention this year is to be primarily a study of the place that the allied arts will take in the school curriculum of the postwar era. It is planned to make it a postwar planning institute.

(Continued on page 20A)



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Filing Hints to meet war-time needs

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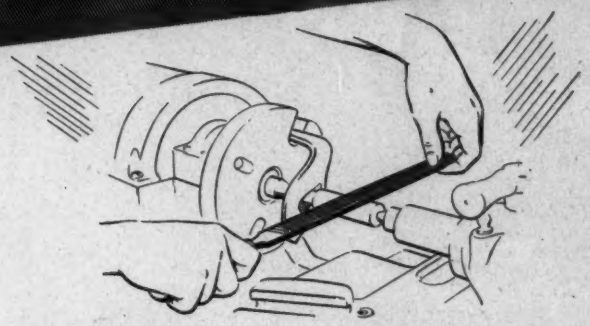

LATHE FILING

Widely used in industry for fitting and finishing shafts, lathe filing is an operation in which the file is stroked against the work while it revolves in a lathe. Lathe filing is commonly employed to correct the slight taper that sometimes results where the lathe cutting tool has been improperly ground or set for the wrong lathe speed or feed.

First,—select a Mill File. Or, if available, use a Long Angle Lathe File that will give a true shearing cut without producing ridges or scores. Hold the file at a slight angle as shown in the illustration—with the work revolving towards the operator. Use a long forward steady stroke, moving laterally about half the width of the file on each stroke.

Beginners should be careful not to hold the file rigid or stationary, but to keep stroking continually. The speed of the lathe should be increased to about 50% higher than that for regularly turning work of the same diameter.

☆ ☆ ☆

NUCUT "Wavy Tooth" construction is a patented combination of coarse teeth and fine teeth that makes possible clean, deep, true cutting and also smooth finishing, both at the same stroke.

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America's Oldest File Manufacturers — Good Tools Since 1836

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HELLER NUCUT WAVY TEETH FILES

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(Continued from page 18A)

Mrs. Bernice V. Setzer, director of art education in Des Moines, Iowa, is president of the association. Mr. Carl Hamburger, supervisor of industrial arts in Cleveland, Ohio, is vice-president. Mr. Edwin J. Bruns, supervisor of art in Cedar Rapids, Iowa, is general program chairman. —*Joseph K. Bolts*, Secretary-Treasurer.

♦ The Board of Control of the Illinois Vocational Association voted to hold the 1944 convention in Springfield, April 14 and 15, with headquarters at the Abraham Lincoln Hotel. The I.V.A. Board of Control decided to hold the convention in Sprinfield in order to avoid holding two similar conventions in Chicago during the same school year. Plans are already well under way to have an outstanding state convention, and to center it around the many problems that the war has brought to vocational and practical arts education in Illinois.

The I.V.A. Journal, for the time being, will be combined under the editorship of Mr. Fletcher, with a journal from the state department, and thus attempt to meet the needs of the membership until war conditions again permit the regular publication of the I.V.A. Journal.

News Notes

♦ A new booklet, on "Recharging Instructions for Carbon Dioxide Extinguishers," has been published by the C-O-Two Fire Equipment Company, Newark 1, N. J., and made available to its field service agents and recharging stations. The booklet, which has been made up in pocket size, is illustrated with detail drawings of the equipment required for recharging and the procedure to be followed in recharging both system cylinders and portable extinguishers made by the C-O-Two Company.

Copies of the booklet will be sent on request to those with facilities for recharging C-O-Two equipment.

♦ The Hycar Chemical Company, 335 South Main St., Akron, Ohio, has furnished an 8-page glossary, 5½ by 8½ in. in size, giving pronunciations and meanings of synthetic rubber words.

The preface of the booklet states that it is designed to help business, industrial, and sales executives, and their associates in discussion of this subject, and is not a highly scientific treatise. The pamphlet includes only the more common chemical terms and some of the well-established trade names.

Copies of the booklet entitled "Chemical Names and Terms Frequently Encountered in the Synthetic Rubber Industry," may be obtained by writing the company.

♦ Men are needed to supervise operations of registered distilleries and internal revenue bonded warehouses, it was announced by the U. S. Civil Service Commission. Persons selected will act as storekeeper-gaugers at a monthly salary of $231 for a 48-hour week.

Applicants must be at least 23 years of age and must have high school education or the equivalent. Training in chemistry or physics is desirable, but not essential. The ability to handle figures accurately is required. Appointees must be able to pass a rigid physical examination and a thorough character investigation, and be willing to work anywhere within the states of Illinois, Indiana, and Wisconsin.

Interested persons should file an application without delay with the Civil Service Commission, New Post Office, Chicago 7, Ill.

♦ Free evening instruction in teaching methods will be offered by the New York State Education Department for skilled craftsmen at its Industrial Teacher-Training School, 227 East Ninth St., New York City, to meet the need for instructors of trades in the vocational schools.

Candidates for the courses will be given practical trade tests by the New York City Board of Examiners, in cooperation with the state department, to determine their competence. To qualify for admittance to the courses, candidates must be between the ages of 23 and 35 and must have had five years of journeyman experience beyond a satisfactory apprentice period. Applicants must be citizens.

The accepted candidates will attend the teacher-training school two evenings a week. Graduates of the school receive a diploma which gives them consideration for teaching positions throughout the state of New York, as well as in the New York City schools. It does not, however, place them on a New York city eligible list.

Applications and complete instructions may be secured by writing to Gilbert G. Weaver, supervisor of industrial teacher training, 227 East Ninth St., New York City.

♦ Widespread aid to educational curriculums in colleges and schools is forecast as one of the objectives that will be attained through the new series of 150 visual units which are being released by the U. S. Office of Education and distributed through Castle Films, Inc. These motion pictures and film strips are a continuation of a governmental program which was instituted before the attack on Pearl Harbor. It is estimated that more than 100,000,000 feet of these 16mm. sound films will be in operation this year.

Outstanding among the uses of the sound films and slides in assisting the national war effort is their application to the industrial training in war plants. Millions of man-power days have been saved through the reduction of the training period for novices. In all branches of the armed forces sound pictures have been and still are employed in teaching battle duties to service personnel.

♦ The U. S. Office of Education has recently issued a pamphlet called "Juvenile Delinquency and the Schools in Wartime." This leaflet, No. 8 in the School Children and the War Series, is based on answers to a questionnaire sent out by the U. S. Office of Education to which 65 school superintendents in 29 states replied.

Reports from school administrators included

(Continued on page 22A)

UNION CARBIDE REPORTS

first full-year's production of

BUTADIENE

for the Government's Synthetic Rubber Program

(INSTITUTE, W. VA. PLANT)

Night view of the immense butadiene plant at Institute, W. Va.

A LITTLE OVER A YEAR AGO* the first tank car of butadiene was shipped from the Government's large integrated rubber project at Institute, W. Va. This historic shipment came from the immense butadiene plant which was designed and built by CARBIDE AND CARBON CHEMICALS CORPORATION for the Government's Defense Plant Corporation—and is being operated by this Unit of UCC, for the Rubber Reserve Company.

FIRST YEAR'S PRODUCTION OVER THE RATED CAPACITY—that is the record of this huge 80,000-ton-per-year plant during its first twelve months! This has been accomplished in spite of the many inherent problems that had to be solved in starting a wholly new project of this magnitude.

Over 8/10 of a short ton of butadiene is required to make about one long ton of Buna S type synthetic rubber. Butadiene from this plant during the past year has provided more than 90,000 long tons of synthetic rubber for the Nation's requirements, both military and essential civilian. The delivery of this all-important ingredient also has made possible early production of synthetic rubber under the Government's program.

*The first tank carload of butadiene from Institute was shipped on February 18, 1943—less than one month after Unit No. 1 of the four large butadiene-producing units had started operating. Subsequently, Unit No 2. started producing in March, Unit No. 3 in April, and Unit No. 4 on May 25, 1943.

NOW HUGE BUTADIENE PRODUCER—although originally designed to produce 80,000 tons annual capacity, the Institute plant is now delivering butadiene at a rate of more than 100,000 tons per year. An identical plant using Carbide's process was put into operation by the Koppers United Company in September, 1943, at Kobuta, near Pittsburgh, Pa.

OVER 75% OF THE TOTAL PRODUCTION OF BUTADIENE for the Government's synthetic rubber program in 1943 came from the alcohol process developed by CARBIDE AND CARBON CHEMICALS CORPORATION.

In addition to the plant at Institute, Carbide made available plans for the large plant at Kobuta, which was built and is being operated for the Government by Koppers United Company.

CARBIDE AND CARBON CHEMICALS CORPORATION also has designed and built for the Defense Plant Corporation, and is operating for the Rubber Reserve Company, another large butadiene plant at Louisville, Ky.

▼

Business men, technicians, teachers, and others are invited to send for the book K-4 "Butadiene and Styrene for Buna S Synthetic Rubber from Grain Alcohol," which explains what these plants do, and what their place is in the Government's rubber program.

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The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
Bakelite Corporation
Plastics Division of Carbide and Carbon Chemicals Corporation

The material herein has been reviewed and passed by the Office of Rubber Director, the Rubber Reserve Company, the Defense Plant Corporation, and the War Department.

(Continued from page 20A)

in the pamphlet indicate that schools are tackling the delinquency problem from a constructive angle by providing activities and guidance to steer children away from the delinquent rolls.

The pamphlet may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 10 cents.

♦ The education section of the War Finance Division, U. S. Treasury Dept., Washington, D. C., is making available a 20-minute playlet, "The Squander Bug," written by Aileen Fisher, to elementary and junior high schools. The squander bug is the villian who fattens on the money squandered instead of investing it in war bonds. Copies of the play may be obtained gratis.

♦ A group of educational films, produced and heretofore distributed by the University of California, will henceforth be rented and sold through the Bell & Howell Company Filmosound Library. Included in the group are school-made films dealing with widely varying subject matter. Among them is one called "Making a Stained Glass Window." This is a comprehensive process film showing each step in the making of large stained glass windows, using American materials and craftsmanship. Showing time, 20 minutes; price, $6.

HELP CRIPPLED CHILDREN

The eleventh annual sale of Easter seals for crippled children, sponsored by the National Society for Crippled Children and its affiliated organizations, will be conducted up to April 9.

The annual sale of Easter seals this war year of 1944 comes as a reminder of the problem of the crippled youth of America — a problem which is underlined by the nature of the times.

The revenues derived from the annual sale of the Easter Seals in past years have helped make possible the physical restoration and training of many crippled children who have since become useful and happy citizens. This task of restoring crippled children to usefulness is a continuing one. It is a task of increasing importance in a nation

that needs all available man power to sail the ships, fly the planes, fight at the fronts, and man the production lines.

Help build crippled children into happy and useful men and women.

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Plan for
TOMORROW
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FREE—
A 24-PAGE
BROCHURE
OF IDEAS FOR
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★ SCHOOL SHOPS
★ TEACHING UNITS
★ HOMEMAKING ROOMS
★ SPECIAL ROOMS
★ NOW ON THE PRESS
★ WRITE FOR YOUR COPY TODAY
Here is a brochure that deals in ideas — ideas which may or may not be used in tomorrow's classrooms. Here men with practical ideas were given the opportunity to plan classroom equipment without being tied down by tradition or convention. The result of this experiment we know you will find interesting; particularly so to School Administrators, Architects and Teachers who are planning tomorrow's classrooms. Essentially, here is a presentation that forgets the past, deals with tomorrow's problems, and dares to suggest new and revolutionary ideas for your consideration. Write today for your copy.
E. H. SHELDON & CO. MUSKEGON, MICH.

Questions and Answers

FINISHING A HUNTING LODGE

1104. Q.: I have just completed a lodge on a lake in the north woods where there are no painters. I must, therefore, do the painting and finishing myself. In this lodge there is a large studio room 24 by 36 ft. with high ceiling, finished with red pine throughout. I would like a sort of lichen tone to it — gray-blue, letting the grain, which varies in color here and there, show through slightly; a pearl gray paint with some blue added gives me pretty much what I want, and I had about decided to just make this paint up and use as a stain, afterwards varnishing. Then I saw that you discredit oil colors as fading and bleeding. I have interviewed dye firms relative to obtaining water stains that will produce something in the way of the color I want, but none of them could give me any advice on how to obtain such effect and suggested that I had better use oil colors.

There is a window 14 ft. across the front of this room, bringing in all outdoors, so that there will be a lot of light pouring into the room, and I do not want to use a color which fades out.

I have been given to understand that shellac and varnish used in conjunction with the same job is not good practice; therefore, whatever stain effect I use, I am not sure whether to shellac to seal and then varnish, or merely varnish. I would like a flat finish, but would forego this if the use of spar varnish with its high gloss would be better for permanency and protection. There will be altogether too much surface to begin rubbing down to obviate gloss. — *H. T. B.*

A.: The term "oil colors" is too loosely applied in the painting and finishing trade. Actually the usage is "oil soluble colors" and "colors ground in oil" — two very widely disassociated and differentiated terms.

The first, "oil soluble colors," is a long list of dyestuffs which are capable of being *dissolved* or at least produce higher suspensions so finely divided that to all intentions they *are* solutions, or dyes, in oils.

(Continued on page 24A)

HIGGINS AMERICAN WATERPROOF DRAWING INKS

THIS IS A PRINTED COLOR CARD

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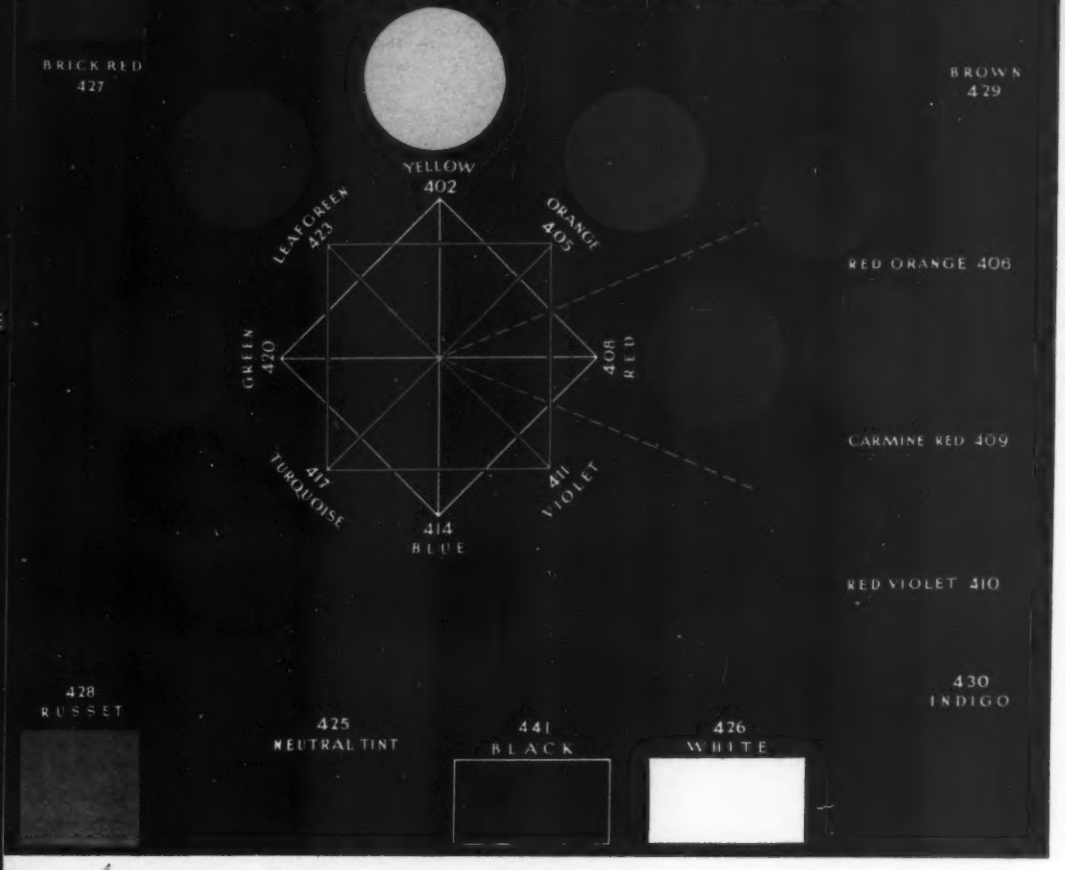

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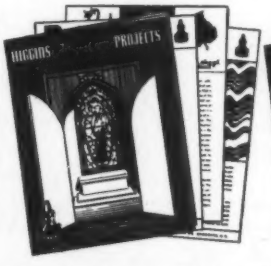

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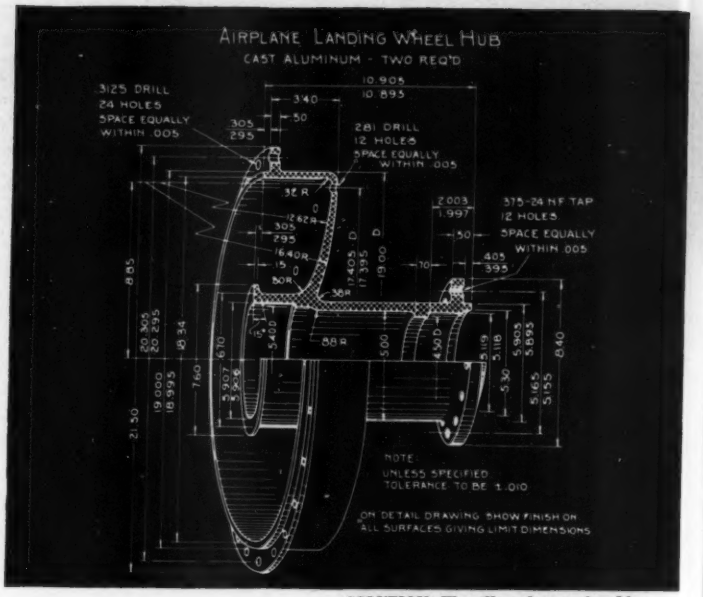
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(Continued from page 22A)

The second, "colors ground in oil," refers to that class of color pigments used by artists, house painters, and technicians whereby solid colors of an *insoluble* type are mechanically ground or milled in an oil medium such as linseed or soya bean. They are in no sense dyes.

The first group is fugitive, or fades, up to and including as much as 85 per cent.

The second group, when made of earth colors such as Sienna or Umber, are nonfacing, or permanent. This is not true of manufactured chemical type, precipitated pigments, as the green or yellow chromes, blues, and some reds. On the whole, pigmented colors can be considered as permanent today if purchased in quality grades.

In the case of the interior trim of the log cabin mentioned in the letter, if a good grade of house paint is reduced with Du Pont Penetrating Wood Finish to make a very thin paint of the desired color, this material can then be brushed on the woodwork and soon afterwards wiped off with rags to secure the color and permanent, nonfading finish with a soft sheen as desired. A very little experimenting to ascertain the amounts required to produce a given effect is all that will be required. No further varnish or other material should be applied later. — *Ralph G. Waring.*

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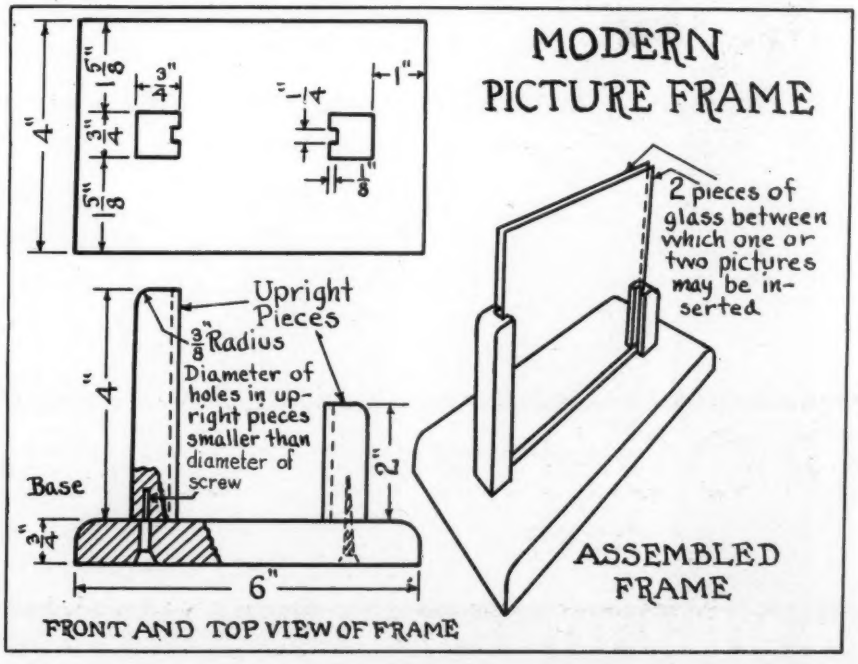
If wood is used for the frame, it is advisable to use any wood that will look well when finished with clear lacquer or shellac. The upright pieces are screwed and glued to the base. The grooves for the glass in the wooden upright pieces are cut with a chisel. The glass should fit snugly in the grooves. The sharp edges of the glass should be smoothed down by rubbing them on sandpaper after the glass is cut.

If the frame is made of plastics, use plastic cement, or plastic cement and drive screws, to fasten upright pieces to base. Drilled holes for drive screws must be slightly smaller than diameter of screws. The grooves in the plastic material may be cut with a saw and finished off with a small coarse file. Rough spots are sandpapered off with No. 7/0 or the finest sandpaper that can be obtained. It is advisable to use the sandpaper wet, as it will last longer and cut better. The plastic frame may be polished on a buffing wheel or by hand with

(Continued on page 27A)



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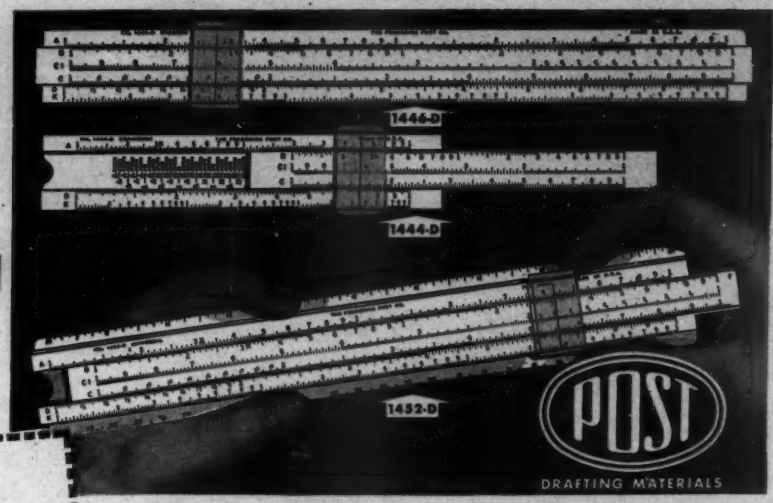

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(Continued from page 24A)

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New Publications

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By Rolland Jenkins. Cloth, 179 pages, 5⅜ by 7⅞ in., illustrated. Price, $1.75. McGraw-Hill Book Co., New York City.

A textbook for training inspectors. It contains chapters on the basis of measurement, tolerances, and limits, nonprecision and precision tools, gauges, and devices. Also contains explanations on the inspection procedures and mathematics of inspection.

Physics: A Basic Science

By Elmer E. Burns, Frank L. Verwiebe, and Herbert C. Hazel. Cloth, 656 pages, 6¼ by 9¼ in., illustrated. Price, $1.80. D. Van Nostrand Co., Inc., New York, N. Y.

High school physics divided into 25 units which give the student an understanding of what constitutes matter, force, motion, machines, energy and power, heat, sound, light, magnetism, electricity, a.c. and d.c. electricity, and electronics.

Teachers for Our Times

A statement of purposes by the Commission on Teacher Education. Published by American Council on Education, Washington, D. C. Cloth, 179 pages, 6⅜ by 9¼ in. Price, $2.

The preliminary report of the Commission on Teacher Education of the American Council on Education. The report has been divided into four chapters which treat the subjects under the following headings: The American Teacher; Our Country, Our People; Our Children, Our Schools; and Teachers for Our Times.

Ferrous Metallurgy, Volume I

By Ernest J. Teichert. Cloth, 484 pages, 5½ by 8½ in., illustrated. Price, $4. McGraw-Hill Book Co., New York City.

The second edition of this text on the physics and chemistry of iron. The book also gives a very thorough explanation of blast furnace chemistry, mathematics, and operation.

Make It for the Children

Paper, 36 pages, 5⅞ by 8¾ in., illustrated. Price, 50 cents. Bulletin of the Association for Childhood Education, 1201 Sixteenth St., N.W., Washington, D. C.

A collection of projects, covering playground apparatus, child and doll furniture, and toys made out of lumber much of which can be salvaged from boxes and crates.

Basic Mathematics for War and Industry

By Paul H. Daus, John M. Gleason, and William M. Whyburn. Cloth, 277 pages, 5⅞ by 8⅝ in. Price, $2. The Macmillan Co., New York, N. Y.

A book designed to assist the mechanic in industry and the man in our armed forces with the basic mathematics which they will need in their respective activities to do their jobs in an efficient manner.

The contents consist of an excellent review of common arithmetic and algebra, and a practical presentation of plane and solid geometry, and plane and spherical trigonometry.

Tables of powers and roots, four-place logarithms, and four-place natural and logarithmic trigonometric functions have been appended.

Fundamentals of Electricity

By Fred R. Miller. Cloth, 220 pages, 5⅞ by 8⅛ in., illustrated. Price, $1. D. C. Heath & Co., Boston, Mass.

A course based on the War Department's PIT-101 requirements. It was written for the purpose of giving boys and young men the right kind of background for further specialized training after they had entered the armed forces.

Elements of Electricity

By Erich Hausmann. Cloth, 260 pages, 6⅛ by 9⅛ in., illustrated. Price, $1.24. D. Van Nostrand & Co., New York City.

A book written to meet the requirements of the PIT No. 101 outline.

It covers the fundamentals of electricity required by the men entering the army with the intention for further specialization requiring a good background in electricity.

Supervising the Woman War Worker

Paper, 34 pages, 5¼ by 7⅞ in. Price, 50 cents. Published by National Foremen's Institute, Inc., Deep River, Conn.

A book written for personnel managers, executies, foremen, and supervisors who have to oversee the women workers who are found in ever increasing numbers in our industrial plants.

American Diesel Engines

By E. F. Goad. Cloth, 313 pages, 6¼ by 9⅜ in., illustrated. Harper & Brothers, New York City.

A textbook covering the study of fuels and combustion; the Diesel principle; construction of the engine; automotive, stationary, and marine engines; and starting, operating, overhauling, and maintenance of this particular type of liquid fuel engine.

It is a beginner's text for use in industrial-arts and vocational classes, as well as in classes for training men of our armed forces.

A Start in Meteorology

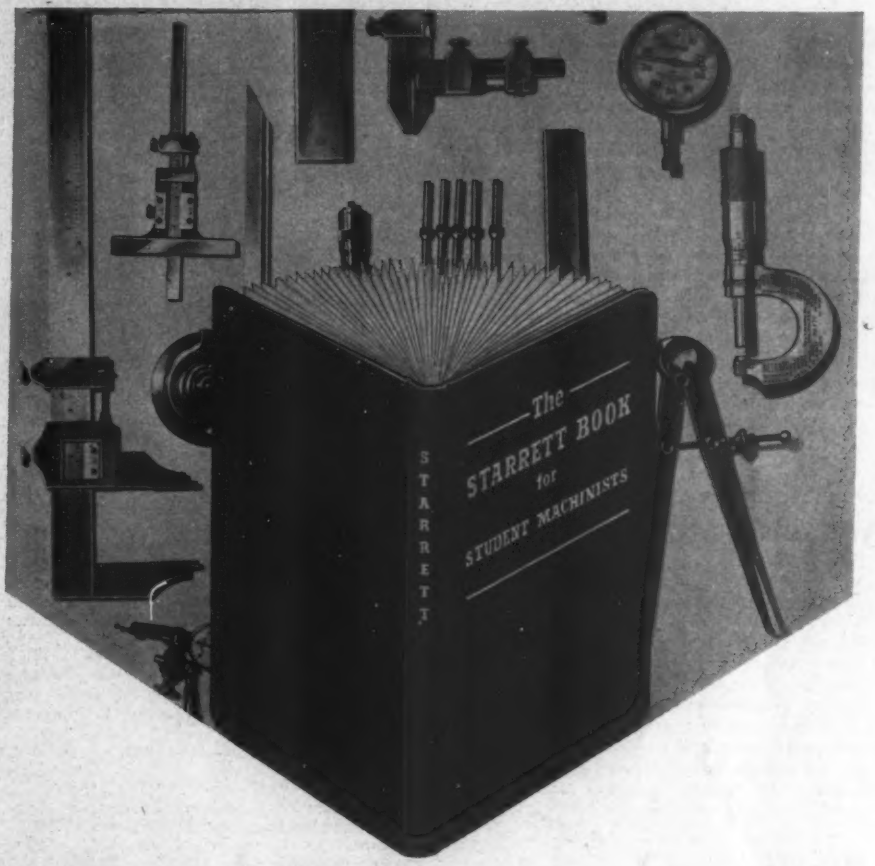
By Armand N. Spitz. Cloth, 95 pages, 5½ by 7¾ in., illustrated. Price, $1.50. Norman W. Henley Publishing Co., New York City.

A beginner's book for training high school students interested in preparing for jobs in the aeronautical field.

Aircraft Production Illustration

By George Tharratt. Cloth, 201 pages, 8¼ by

(Continued on page 39A)



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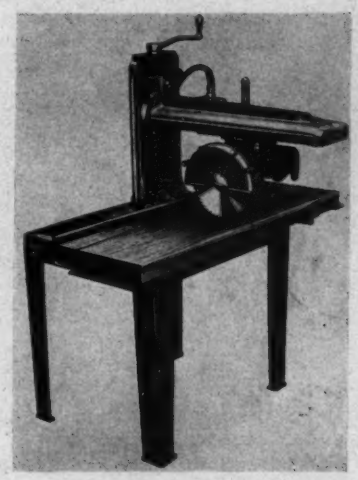
Shop Equipment News

New Products — Publications

WALLACE NO. 1 RADIAL SAW WITH ANGULATOR

As an accessory to the Wallace No. 1 Radial Saw, J. D. Wallace & Co., 140 S. California Ave., Chicago, announce a patented "Angulator" incorporating two adjustable stops. These stops position the machine to alternately make any two angle cuts on a piece of material before removing it from the table.



Radial saw with Angulator

With this machine the motor moves back and forth in the arm for sawing, the material lying stationary on the table. The saw is fitted with a degree scale and lock pins to locate the square cutoff position and commonly used angles.

The Wallace Radial Saw derives its name from the fact that the column, arm, and motor are all radially mounted. These parts rotate 360 deg., and may be locked in any position. These features provide a saving in space.

Other recent improvements in the Wallace Radial Saw include tables with adjustable tops for aligning them parallel with the radial arm, and portable steel skid tables for carrying the machine to the work.

For brief reference use IAVE—410.

36-IN. BAND SAW

In addition to its several different size band saws, American Saw Mill Machinery Co., Hackettstown, N. J., recently announced a new modern designed 36-in. Band Saw Model X 40, rigid, high speed, and possessing many practical features.

The table can be tilted 45 deg. to the right, and 5 deg. to the left. The wheels run at 900 r.p.m. They are of the steel disk type, dynamically balanced, and have demountable rims and removable steel-reinforced tires.

It is provided with direct drive 5 h.p. or 7½ h.p. motors. This saw is built for high speed accurate production, and is sturdy enough to withstand hard service.

For brief reference use IAVE—411.

IMPROVED POWER SAWS

The improved Peerless Metal Cutting Power Saws, which offer streamlined design and new features of special interest to present and postwar production men, have been announced by The Peerless Machine Co., Racine, Wis. In the new models are incorporated a new hydraulic unit. The hydraulic micro-set length gauge is mounted on the conveyor to accurately gauge the length

Metal cutting power saws

of cut. Feed pressure is adjusted by Vernier finger-tip screw control. Feed pressures can be selected to the accuracy of ounces. The oil capacity of the feed unit has been increased 75 per cent.

A four-sided saw frame completely surrounds the blade and the work. A backing-plate blade support backs up the blade to permit the application of maximum feed pressure with minimum strain on the blade. The saw frame is balanced in its reciprocating travel by dual hydraulic cylinders. The driving force is always centrally applied. By increasing the chip capacity 60 per cent, fewer cleanup periods are required.

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Continuous photographic printer

Used with the new semiphotographic materials, this new printer, known as the Bruning 55C Continuous Photographic Printer, provides clear and faithful duplicates of anything typed, printed, photographed, or drawn. The 55C is a 42-in.

(Continued on page 31A)

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(Continued from page 28A)

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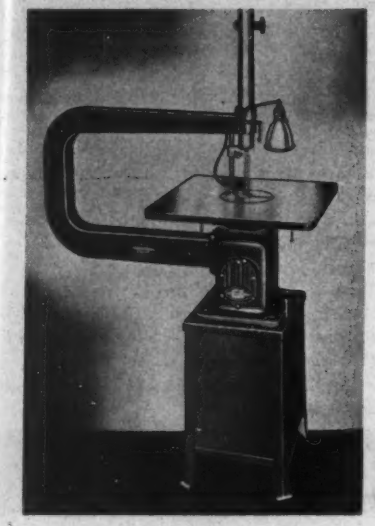

Heavy duty jig saw

Two to three times more area and support for work is made possible by the 20 by 20-in. oversize, polished, cast-iron worktable which tilts both ways 45 degrees. By removing the U frame and using saber saws there is no limit to the size of the panel that can be cut. Bevels of 45 in. can be ripped on long lumber.

When the upper head is turned, the blade guide, blower, and hold-down all follow around as one unit.

An exclusive calibrated tensioner knob shows correct spring tension for every kind and size of blade.

The base is a heavy single iron casting; and the two long-wearing, widely spaced, fully lubricated bronze bearings accurately guide the upper plunger and prevent blades sticking and breaking.

Easy to read, scribed lines indicate exact position of head for ordinary sawing, or for ripping crosswise to frame.

The mechanism is splash lubricated.

For brief reference use IAVE—414.

BOOKLET ON TYPE FOUNDING

The American Type Founders, Elizabeth, N. J., who operate the oldest type foundry in this country, have just issued a fascinating booklet entitled, "Looks . . . Plus," describing graphically how the firm makes its type. This informative booklet will be of interest to printers, typographers, graphic-arts teachers, members of craftsmen's clubs, and anyone having to do with type.

The booklet takes the reader step by step from the artist's original drawing, its enlargement, and the making of the dimensional patterns; through the engraving of the pattern plate and then the matrix on the Gorton and Benton machines respectively; and the precision testing. These operations are all illustrated by large half tones, supplemented by terse captions. The casting processes,

(Continued on page 36A)

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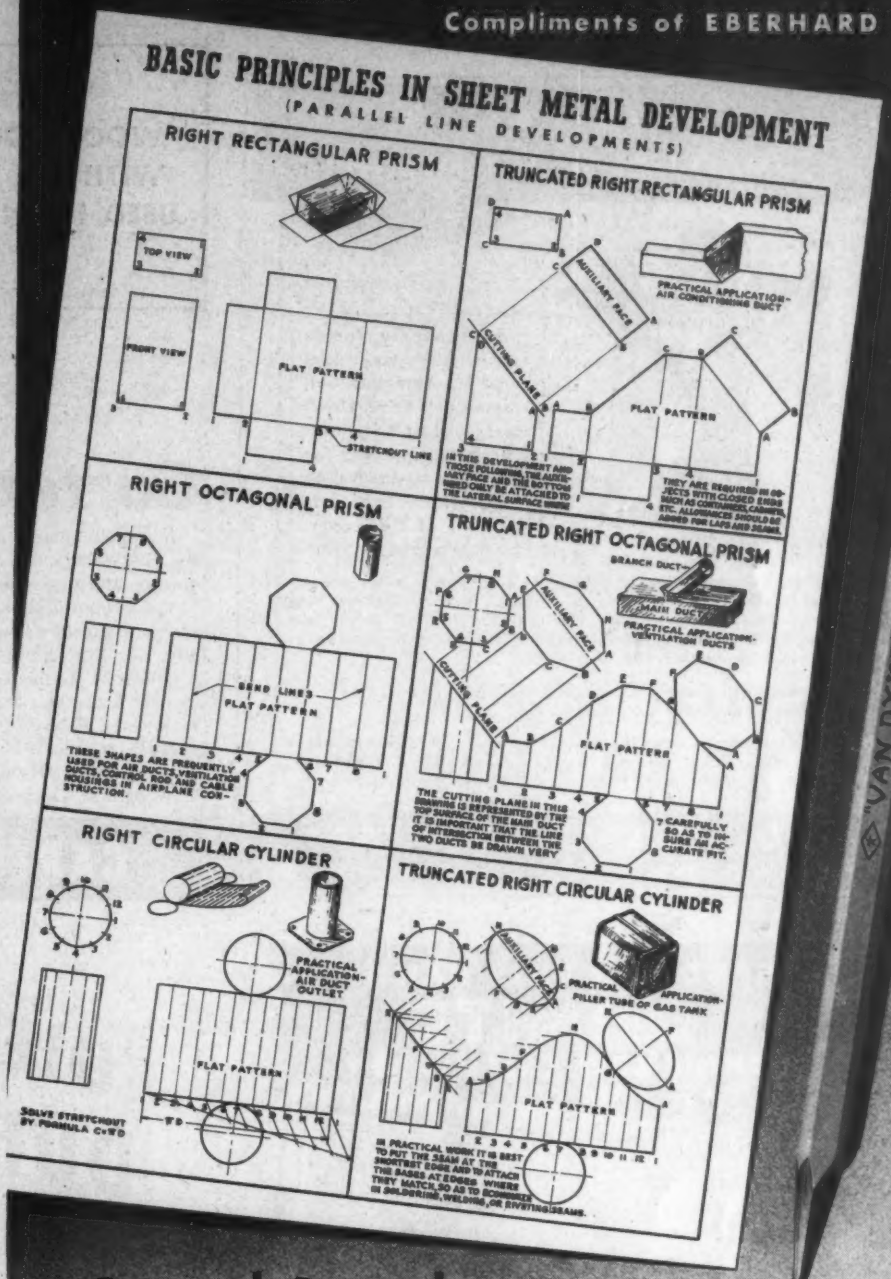
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(PARALLEL LINE DEVELOPMENTS)
RIGHT RECTANGULAR PRISM
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FRONT VIEW
PLAT PATTERN
STRETCHOUT LINE
TRUNCATED RIGHT RECTANGULAR PRISM
AUXILIARY FACE
CUTTING PLANE
PRACTICAL APPLICATION-AIR CONDITIONING DUCT
PLAT PATTERN
IN THIS DEVELOPMENT AND THOSE FOLLOWING, THE AUXILIARY FACE AND THE BOTTOM SHALL ONLY BE ATTACHED TO THE LATERAL SURFACE WHERE
THEY ARE REQUIRED IN OBJECTS WITH CLOSED ENDS SUCH AS CONTAINERS, CABINETS, ETC. ALLOWANCES SHOULD BE MADE FOR LAPS AND SEAMS.
RIGHT OCTAGONAL PRISM
BEND LINES
PLAT PATTERN
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TRUNCATED RIGHT OCTAGONAL PRISM
BRANCH DUCT
MAIN DUCT
AUXILIARY FACE
CUTTING PLANE
PRACTICAL APPLICATION-VENTILATION DUCTS
PLAT PATTERN
THE CUTTING PLANE IN THIS DRAWING IS REPRESENTED BY THE TOP SURFACE OF THE MAIN DUCT. IT IS IMPORTANT THAT THE LINE OF INTERSECTION BETWEEN THE TWO DUCTS BE DRAWN VERY CAREFULLY SO AS TO INSURE AN ACCURATE FIT.
RIGHT CIRCULAR CYLINDER
PRACTICAL APPLICATION-AIR DUCT OUTLET
PLAT PATTERN
SOLVE STRETCHOUT BY FORMULA C×D
TRUNCATED RIGHT CIRCULAR CYLINDER
AUXILIARY FACE
PRACTICAL APPLICATION-FILLER TUBE OF GAS TANK
PLAT PATTERN
IN PRACTICAL WORK IT IS BEST TO PUT THE SEAM AT THE SHORTEST EDGE AND TO ATTACH THE BANDS AT EDGES WHERE THEY MATCH, SO AS TO ECONOMIZE IN SOLDERING, WELDING, OR RIVETING SEAMS.

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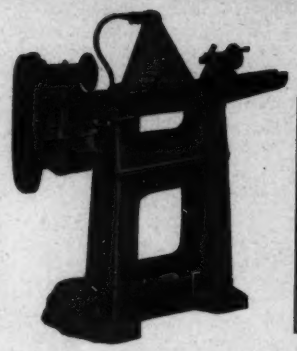

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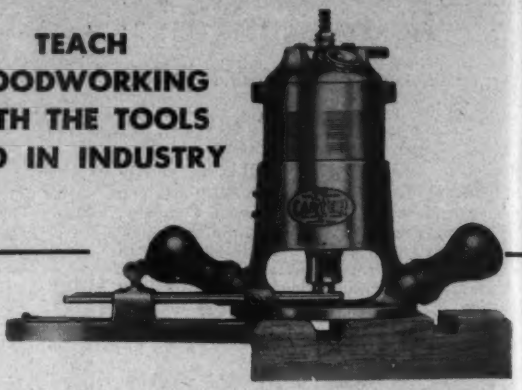

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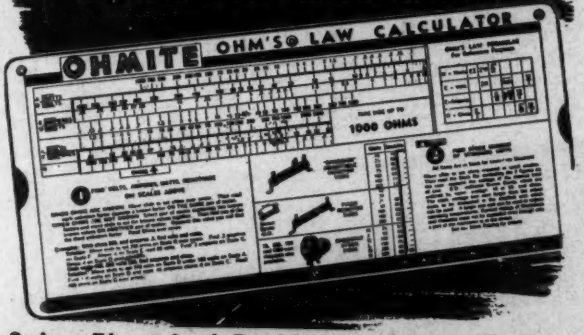

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This book gives a brief non-technical explanation of some common types of plastics. It contains trade names for some plastic productions and tells how they are used in industry. Instruction is given on how to fabricate and polish the phenolic resins.

Write for approval copies and complete catalog

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Bloomington, Illinois

(Continued from page 178)

18. *House Wiring* by Poope (New York City: N. W. Henley and Company).
19. *Practical Radio* by Moyer and Wastrel (New York City: McGraw-Hill Publishing Company).
20. *Electricity Simplified* by Sloane (New York City: N. W. Henley and Company).
21. *Lessons in Practical Electricity* by Swope (New York City: D. Van Nostrand Company).
22. *Electric Wiring* by Schuler (New York City: McGraw-Hill Publishing Company).

CAR WASHING LADDER

GARROTT BARICH
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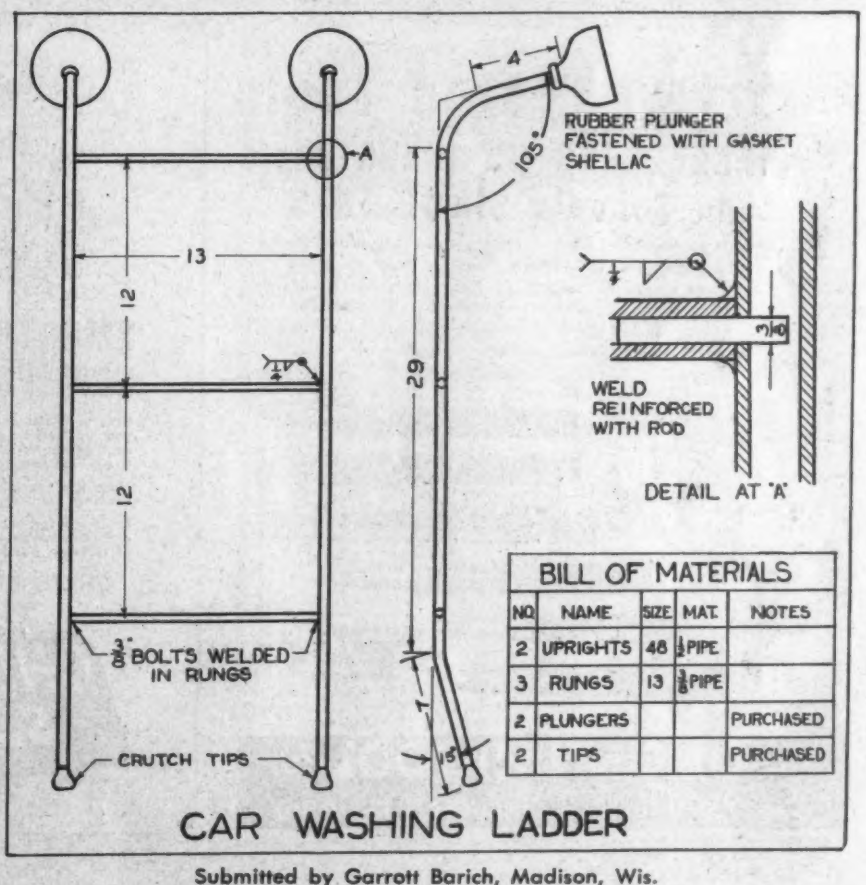
The car washing ladder shown herewith was designed, constructed, and thoroughly tested in the high school auto-mechanics shop. It can be made by any student who is familiar with the use of the acetylene torch.

The pipe can be bent with a pipe bender or with a bending jig. The rubber suction cups are of the type known as rubber plungers by plumbers. They may be purchased in any ten-cent store. They are better than the smaller rubber adapters commonly used for boat and luggage carriers and can be fitted easier.



CAR WASHING LADDER

Submitted by Garrott Barich, Madison, Wis.

"Industrial education is of two types, the general and the strictly vocational. Administrators should not think of them as being mutually exclusive, but must work to make them function harmoniously as 'closely allied and interdependent parts of a complete service." — *Homer J. Smith.*

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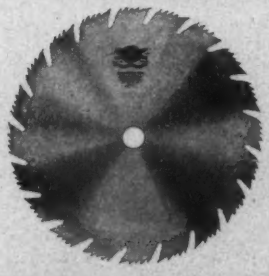

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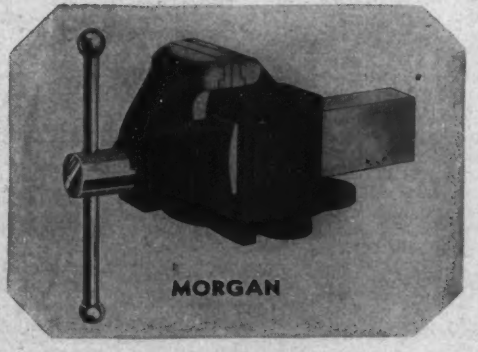

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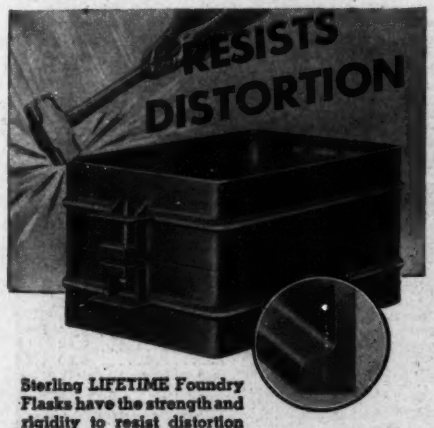

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(Continued from page 31A)

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For brief reference use IAVE—415.

COLOR CARD AND DESCRIPTION OF DRAWING INKS

Higgins Ink Co., Inc., 271 Ninth St., Brooklyn 15, N. Y., announce that they have just issued a new combined ten-page color card and leaflet showing prices and descriptions of their drawing inks. The company has hitherto used only a handmade color card in which the color swatches were made by actually applying Higgins American Drawing Inks to white drawing paper.

Due to the expense of producing this type of card, quantities for dealer use were necessarily limited. The company will still use a handmade card where an authentic sample card is necessary because it is the only means whereby the brilliance of their drawing inks may be accurately shown. They are, however, supplementing their genuine color card with the new printed color card because they can make it available in large quantities.

The color match on the new card is accurate enough for practical purposes. A copy may be obtained by addressing the firm.

For brief reference use IAVE—416.

NEW BRADLEY CATALOG

The Bradley Washfountain Company of Milwaukee, Wis., has just published their new catalog, No. 4308, on wash fountains. This new catalog describes and illustrates the various models of group wash fountains, both full circular and semicircular wall types, and points out the sanitary and water-saving features of the wash fountains, as well as for the multistall showers which this company manufactures.

The catalog is also designated as A1A File No. 29-H for school architects' file reference.

For brief reference use IAVE—417.

SKILSAW CATALOG AND MAINTENANCE MANUAL

"How to Get the Most From Your Portable Electric Tools" is the title of a special section in the new catalog just published by Skilsaw, Inc., 5033-43 Elston Ave., Chicago, Ill. Designed as a handy guide to greater production and longer tool life, this wartime maintenance manual is full of illustrations and valuable suggestions on the care and operation of portable electric tools.

The catalog also carries complete data on and working illustrations of the Skilsaw Portable Electric Tools, so much used in war production and construction. Free copies may be obtained by writing the manufacturer.

For brief reference use IAVE—418.

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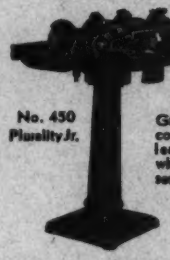

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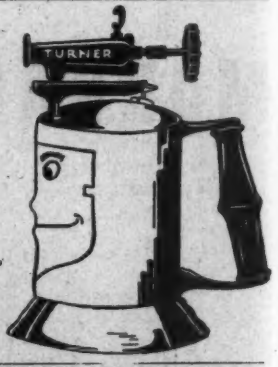

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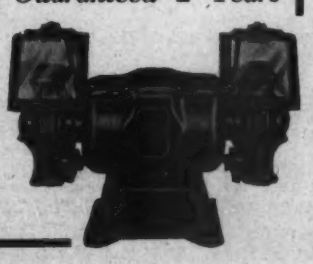

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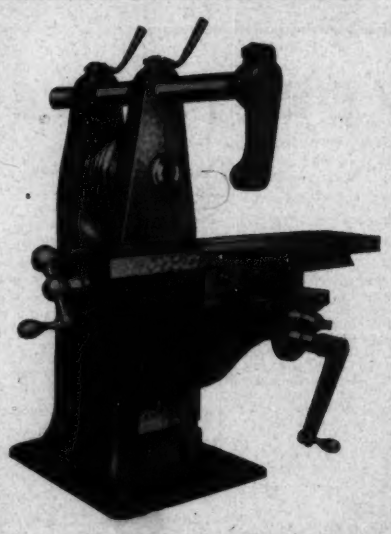

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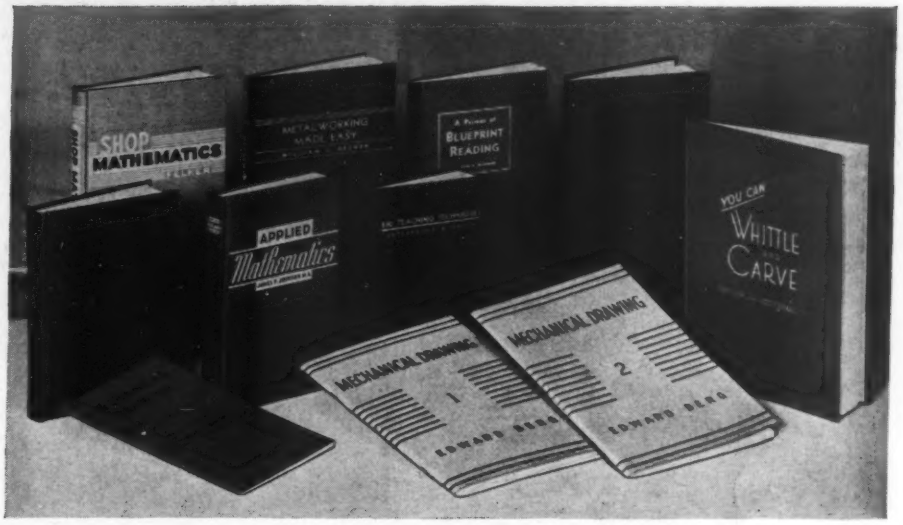

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Turning Tips for Trainees..

No. 5 in a series of "Turning Tips for Trainees"
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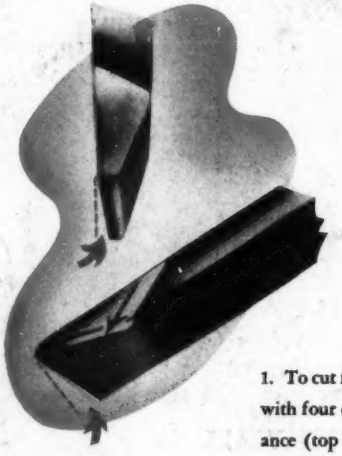
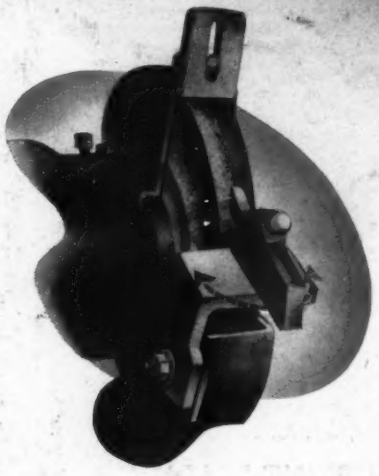
One of the most common causes of trouble in lathe work is a dull or improperly ground tool. I'd like to illustrate a few of the correct steps for giving first aid to "beat up" tools. The best method is the semi-automatic grinding machine. If your tool room has one, let the expert in charge do your grinding. But if you do your own grinding by the offhand method, watch these points.

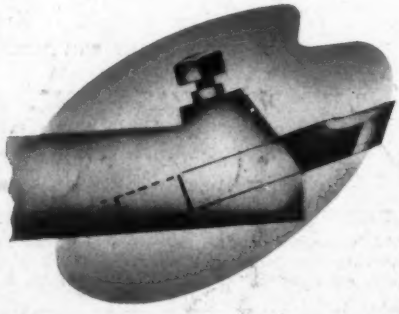


1. To cut free a tool must be ground with four correct angles—side clearance (top drawing) and back rake, side rake, and end clearance (shown on bottom drawing). These angles as well as the shape of the tool vary with the material to be machined. Refer to a tool manufacturer's manual.

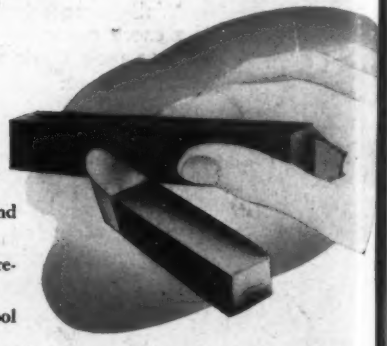


3. The tool is supported on the work rest moved with a rocketing motion over the fa the entire grinding wheel. This prevents the from turning and distributes wear on the w

4. Tools used for finishing or for soft m should be further sharpened with light strok an India oil stone. Use of this stone is also ommended between cuts. For roughing this step is unnecessary.



2. The most satisfactory way to grind a tool bit is in its own holder. To prevent grinding the holder, extend the tool beyond its regular cutting position.



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